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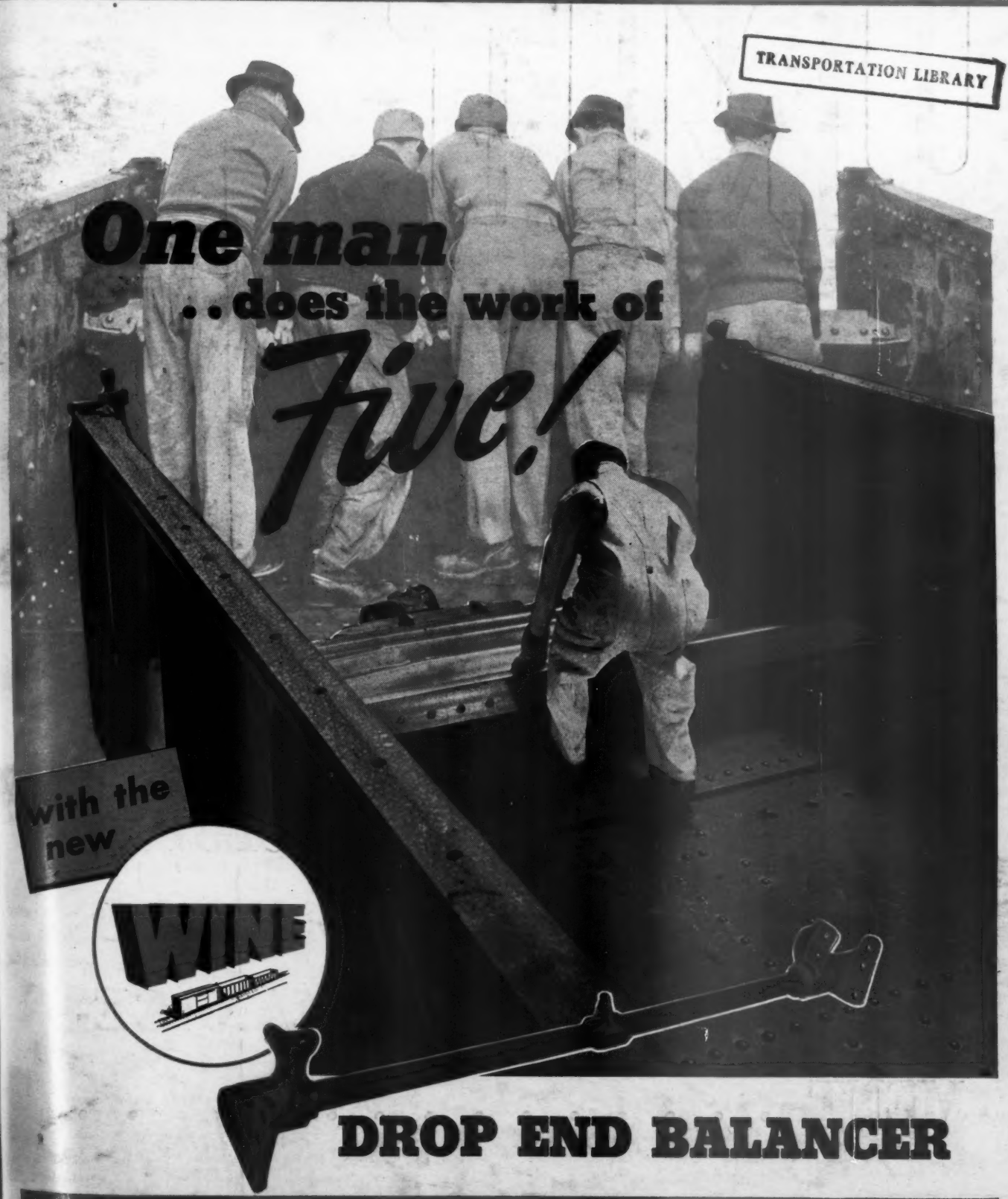

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With which is incorporated the RAILWAY ELECTRICAL ENGINEER

(Names Registered, U. S. Patent Office)

Founded in 1832 as the American Rail-Road Journal

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Some Design Aspects of

Hopper-Car Construction*

By W. B. Brooks†

A discussion of the effects of stresses and drainage on the corrosion and cracking of steel plates and the value of welding in eliminating them

It was the writer's privilege to witness some of the operations in the Chicago, Milwaukee, St. Paul & Pacific's shop which are illustrated in Mr. Rex's excellent paper. They typify progressive engineering, sound production planning and excellent shop management, all centered on welding. These operations also emphasize some statements of Mr. Leland E. Grant, engineer of tests, C.M.St.P. & P., who appropriately says, "Maximum economy in construction combined with good serviceability will be obtained only when the welding is properly engineered."

It is the purpose of this discussion to emphasize certain aspects of welding and corrosion-resistant, high-strength steels as related to design and durability. Fig. 1 is an interior view of a riveted corrosion-resistant, high-strength steel hopper car after ten years of service. The side sheets were $\frac{3}{32}$ in. as compared to the $\frac{5}{16}$ in. or ¼ in. employed for copper-bearing steel. At the ledge formed by the riveted connection between the hopper sheet, side sill, and side sheet, there is local corrosion due to the accumulation of fines, the trapping or moisture between the faying surfaces and electrolytic effects, as explained later. This local corrosion has destroyed about one-third of the thickness of the side sheet and it is starting to fail by corrosion-fatigue in some cars. Several inches above this riveted joint, the sheet retains its original nominal thickness.

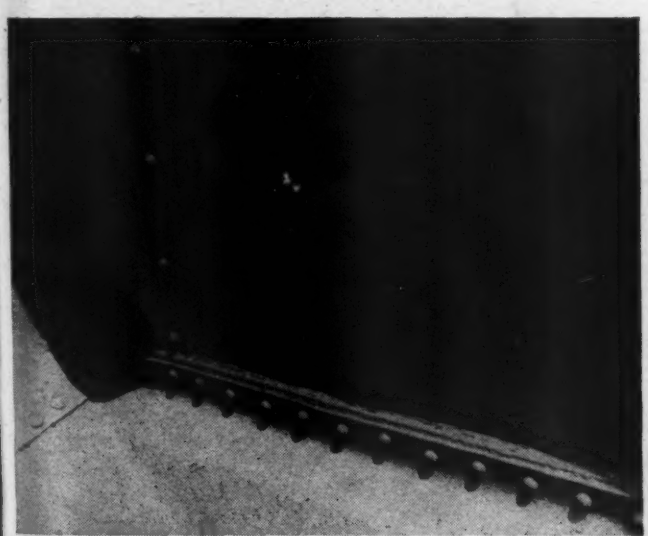

Fig. 1—Typical surface of Cor-Ten steel after ten years of service—Riveting has made a shelf at the bottom of the side sheet which traps fines that catch moisture and generate ferric sulphate

We might properly regard this condition as an example of stress concentration or "notch effect" caused by corrosion. Welding can obviously correct this corrosion notch. A "design notch" is illustrated in Fig. 2. It occurs at the re-entrant angle. Trouble was noted at this point in all the cars of this series examined. This is another case of corrosion fatigue which can be eliminated by proper design involving welding.

Because of its electrolytic character, the corrosion process has an irregular intensity over the surface on which it is acting. The bottom of the irregularities

Fig. 2—Another interior view of a Cor-Ten car after ten years of service—There is stress concentration at the re-entrant angle, a trouble that was noted at this point in all the cars examined

* Discussion of paper on "Welded Freight Car Construction" presented by R. L. Rex, railroad mechanical specialist, Air Reduction Sales Company, New York, before a session of the Railroad Division, American Welding Society, at Atlantic City on November 18, 1946. An abstract of Mr. Rex's paper appeared on page 132 of the March, 1947, issue of the Railway *Mechanical Engineer*.

† Metallurgist and welding engineer, Alloys Development Company, Pittsburgh, Pa.

formed by corrosion are points of stress concentration, and therefore points of relatively higher corrosion rates. Energy relationships alone would give high rates, but in the case of repeated dynamic loading, mechanical effects are more important. Stresses, even within the elastic range, are sufficient to break the film of corrosion products, thereby exposing fresh metal. This condition is illustrated in Fig. 3. As the depth of the attack increases,

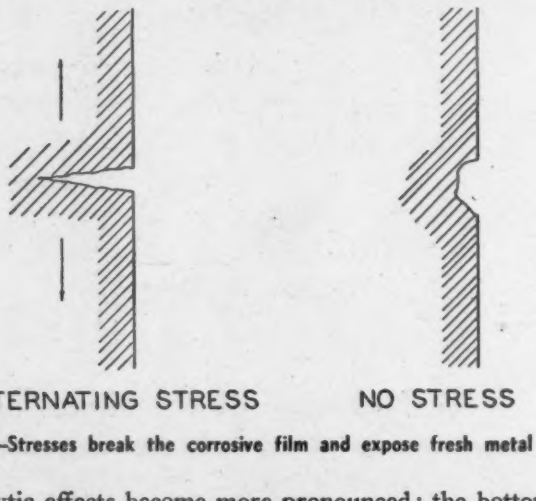

Fig. 3—Stresses break the corrosive film and expose fresh metal

electrolytic effects become more pronounced; the bottom of the depression or pit becomes increasingly anodic with respect to the surrounding area, and cracking ultimately results. Cracks occur even in cases where the general corrosion attack does not appear to be severe, provided there are high repeated stresses.

Metals possess a definite endurance limit only when tested as polished specimens in dry air. This endurance-limit is reduced by irregularities caused by corrosion, faulty design, and faulty fabrication. Fig. 4 shows that

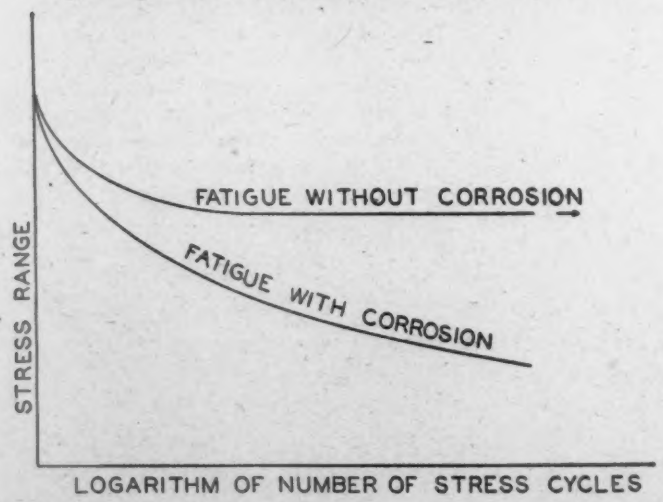

Fig. 4—Effect of corrosion on fatigue behavior of metals

where corrosion is present, there can be no corrosion fatigue limit. The S-N curve under corrosive conditions never becomes flat.

While the horizontal ledge, noted in Fig. 1, provides a source of severe localized corrosion due to fines and dirt resting upon it, lapped joints in general promote corrosion. They interfere with drainage of the surface. Moisture is trapped between their fraying surfaces and electrolytic differences between them and bare metal cause concentration cell corrosion as illustrated in Fig. 5. Butt welding obviously eliminates this condition as shown in Fig 6. Corrosion products and, in some cases, the accumulation of salts build up stresses in the rivets and

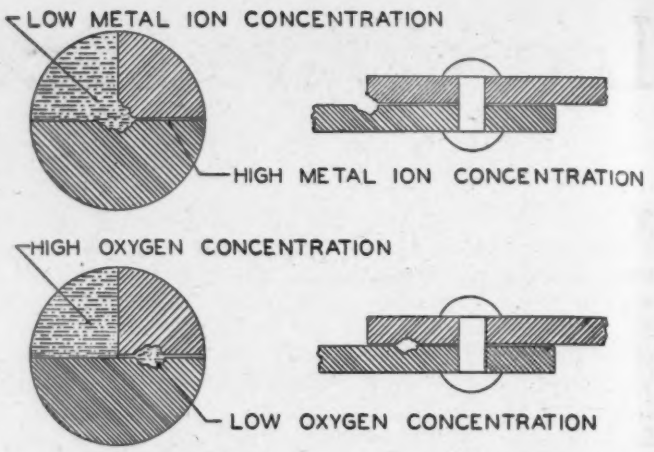

Fig. 5—Two types of concentration cell corrosion common to lapped joints

plates. A special case of this is the stress corrosion cracking of boilers known as caustic embrittlement. Welded boilers constructed of fully aluminum-killed steel and stress relieved may be expected to be virtually free of caustic embrittlement.

Recently, some of these factors have been given serious study resulting in the design of an all-welded light-weight hopper car of high-strength corrosion-resistant steel with smooth self-draining interior surfaces. Material

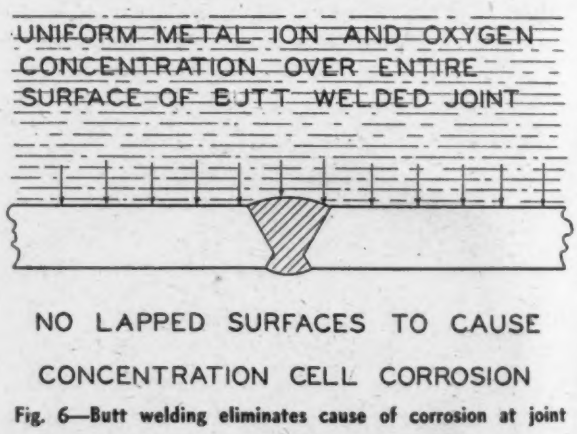
UNIFORM METAL ION AND OXYGEN CONCENTRATION OVER ENTIRE SURFACE OF BUTT WELDED JOINT
NO LAPPED SURFACES TO CAUSE CONCENTRATION CELL CORROSION

Fig. 6—Butt welding eliminates cause of corrosion at joint

costs for this car were within ten dollars of those for a standard riveted copper-bearing steel car of the same type but weighing three tons more and carrying three tons less. Such a car lasts 14 to 15 years before requiring heavy repairs. It is estimated by the writer that the welded Cor-Ten car, Fig 7 will last at least 25 years before needing repairs. In the face of rising costs,

Fig. 7—Welding and high-strength corrosion-resistant steel are combined in this all-welded car to save 6,540 lb. over conventional design

engineering progress of this kind will be of material assistance in maintaining our railroad industry in a healthy condition.

Locomotive Inspection Report

THE thirty-fifth annual report of the Bureau of Locomotive Inspection, Interstate Commerce Commission, issued recently by Director John M. Hall, covering the work of the bureau during the fiscal year ended June 30, 1946, indicates a percentage increase in the number of locomotives—both steam and other than steam—that were inspected and found defective during the period. In the case of steam locomotives, there were, during the fiscal year, 101,869 locomotives inspected which was a decrease of 14,110 as compared with the previous year. Of these 11,337 or 11 per cent of the total were found defective and 690 were ordered out of service.

In the case of locomotives other than steam, there were 10,908 inspected during the period. Of these 499 or 4.6 per cent were found defective and 17 were ordered out of service.

The year covered by the report was particularly unfavorable in the matter of accidents and casualties caused by the failure of some part of the steam locomotive boiler.

Increase in the number of defective locomotives found by the Bureau's inspectors during the year ended June 30, 1946 —Number of boiler explosions and resultant damage increase

Explosions and Other Boiler Accidents

Eighteen boiler explosions occurred in the fiscal year; all were caused by overheating of the crown sheets due to low water. Ten employees were killed in these accidents and 22 employees were injured. There was an increase of 10 in the number of boiler explosions, an increase of 1 in the number of employees killed, and an increase of 10 in the number of employees injured compared with the preceding year.

Two of the explosions occurred on locomotives hauling hospital trains, two occurred on locomotives in passenger-train service, 11 occurred on locomotives engaged in freight-train service, and three occurred while the locomotives were in charge of engine watchmen.

One of these accidents, in which two employees were killed, occurred on the leading locomotive of a double-header which was hauling a hospital train at an estimated speed of 20 m.p.h. The boiler was torn from the running gear, struck the adjacent track, then bounded and came to rest about 350 ft. from the

Table I—The Number of Locomotives in Service, the Number Inspected and the Conditions Found

STEAM LOCOMOTIVES

	Year ended June 30—					
	1946	1945	1944	1943	1942	1941
Number of locomotives for which reports were filed	41,851	43,019	43,297	43,064	42,951	43,236
Number inspected	101,869	115,979	117,334	116,647	113,451	105,675
Number found defective	11,337	11,975	12,710	11,901	10,970	9,570
Percentage inspected found defective	11	10	11	10	10	9
Number ordered out of service	690	506	630	487	474	560
Number of defects found	56,541	53,367	56,617	51,350	44,928	37,691

LOCOMOTIVES OTHER THAN STEAM

	Year ended June 30—					
	1946	1945	1944	1943	1942	1941
Number of locomotive units for which reports were filed	6,616	6,094	5,139	4,351	3,957	3,389
Number inspected	10,908	9,888	7,711	6,847	6,728	5,558
Number found defective	499	447	378	298	358	319
Percentage of inspected found defective	4.6	4.5	4.9	4.4	5	6
Number ordered out of service	17	16	9	6	12	21
Number of defects found	1,385	1,212	1,026	849	928	905

There was a total of 156 accidents attributable to such causes during the period, an increase of 15 over the previous 12-month period. In these 156 accidents ten persons were killed and 165 injured.

Similarly, there was an increase in both the number of accidents and the number of persons injured as the result of a failure of locomotives other than steam. During the fiscal period there were 38 such accidents which fortunately did not result in any loss of life but did result in injuries to 56 persons.

The report called attention to the fact that the fiscal year covered by this report is the first year in the 35 years' history of the bureau in which no deaths occurred in any accident other than boiler explosions caused by the overheating of crown sheets.

Table II—Accidents and Casualties Caused by Locomotive Parts and Appurtenances

STEAM LOCOMOTIVE, INCLUDING BOILER, OR TENDER

	Year ended June 30—					
	1946	1945	1944	1943	1942	1941
Number of accidents	419	410	403	319	222	153
Percent increase or decrease from previous year	2.2[1]	1.7[1]	26.3[1]	43.7[1]	45.1[1]	6.7
Number of persons killed	10	20	25	27	34	15
Percent increase or decrease from previous year	50.0	20.0	7.4	20.6	126.7[1]	16.7
Number of persons injured	439	429	466	373	227	182
Percent increase or decrease from previous year	2.2[1]	7.9	24.9[1]	64.3[1]	24.7[1]	19.1

STEAM LOCOMOTIVE BOILER[2]

	Year ended June 30—							
	1946	1945	1944	1943	1942	1941	1915	1912
Number of accidents	156	141	141	129	81	43	424	856
Number of persons killed	10	13	17	25	30	12	13	91
Number of persons injured	165	154	194	173	83	64	467	1,005

LOCOMOTIVES OTHER THAN STEAM

	Year ended June 30—					
	1946	1945	1944	1943	1942	1941
Number of accidents	38	29	17	15	9	11
Number of persons killed	..	1	..	..	..	..
Number of persons injured	56	40	23	18	9	11

[1] Increase.
[2] The original act applied only to the locomotive boiler.

Table III—Accidents and Casualties Resulting from Locomotive Failures

Steam Locomotives and Tenders and Their Appurtenances

Part or appurtenance which caused accident	Year ended June 30— 1946 Accidents	1946 Killed	1946 Injured	1945 Accidents	1945 Killed	1945 Injured	1944 Accidents	1944 Killed	1944 Injured	1943 Accidents	1943 Killed	1943 Injured	1942 Accidents	1942 Killed	1942 Injured
Air reservoire	1	..	1	1	..	1	3	..	4	..	..	..	1	..	1
Aprons	2	..	2	8	..	8	7	..	7	1	..	1	..	..	..
Arch tubes	..	..	..	..	..	..	1	..	2	..	..	..	..	..	..
Ashpan blowers	1	..	1	2	1	1	..	..	..	1	..	1	1	..	1
Axles	1	..	1	2	..	5	5	1	5	1	..	1	1	..	1
Blow-off cocks	15	..	16	7	..	7	8	..	8	8	..	8	8	..	8
Boiler checks	8	..	8	6	..	7	9	..	9	8	1	7	3	..	3
Boiler explosions:															
A. Shell explosions	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
B. Crown sheet; low water; no contributory causes found	15	7	20	7	9	11	12	7	19	19	22	48	8	18	11
C. Crown sheet; low water; contributory causes or defects found	3	3	2	1	..	1	7	5	43	4	..	6	5	5	
D. Miscellaneous firebox failures	1	..	1	1	..	1	..	..	..	2	2	2	2	..	2
Brakes and brake rigging	10	..	12	10	..	10	12	..	12	11	..	13	4	1	3
Couplers	5	..	5	5	..	6	6	..	9	3	..	3	3	..	3
Crank pins, collars, et cetera	5	..	5	5	1	4	7	..	9	6	1	9	1	..	1
Crossheads and guides	3	..	5	2	..	2	8	..	8	2	..	2	..	..	..
Cylinder cocks and rigging	1	..	1	1	..	1	3	..	3	4	..	4	1	..	1
Cylinder heads and steam chests	1	..	1	2	..	3	1	..	1	5	..	5	1	..	1
Dome Caps	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Draft appliances	2	..	2	2	..	3	2	..	3	1	..	1	1	..	2
Draw gear	1	..	1	2	..	2	1	..	1	1	..	1	..	..	..
Fire doors, levers, et cetera	2	..	2	8	..	8	6	..	6	5	..	5	6	..	6
Flues	10	..	12	5	..	6	8	..	9	5	..	10	3	1	2
Flue pockets	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Footboards	12	..	12	13	1	12	7	..	6	4	..	4	5	..	5
Gage cocks	..	..	..	1	..	1	..	..	..	..	..	..	1	..	1
Grease cups	1	..	1	1	..	1	1	..	1	2	..	3	3	..	3
Grate shakers	25	..	25	17	..	17	19	..	19	18	..	18	12	..	12
Handholds	20	..	20	26	1	25	14	..	14	18	..	18	10	..	10
Headlights and brackets	2	..	2	7	..	7	..	..	..	4	..	4	1	..	1
Injectors and connections (not including injector steam pipes)	14	..	14	12	..	12	8	..	8	7	..	7	4	..	4
Injector steam pipes	2	..	2	1	..	1	..	..	..	2	..	2	2	..	2
Lubricators and connections	5	..	5	4	..	4	5	..	5	7	..	7	5	..	5
Lubricator glasses	2	..	2	1	..	1	1	..	1	..	..	..	1	..	1
Patch bolts	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pistons and piston rods	..	..	..	2	1	1	3	..	3	1	..	1	1	..	1
Plugs, arch tube and washout	1	..	1	5	2	6	6	3	7	2	..	3	3	1	5
Plugs in firebox sheets	1	..	1	..	..	..	1	..	1	..	..	..	..	..	..
Reversing gear	11	..	11	13	..	13	16	..	16	14	..	14	19	..	19
Rivets	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..
Rods, main and side	7	..	7	7	..	11	7	2	9	7	..	10	4	..	5
Safety valves	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sanders	4	..	4	8	..	8	12	..	12	2	..	2	2	..	2
Side bearings	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Springs and spring rigging	6	..	7	5	1	4	6	2	8	7	..	8	2	..	2
Squirt hose	14	..	15	23	..	25	21	..	22	16	..	16	7	1	6
Staybolts	1	..	1	4	..	4	4	1	4	4	..	4	2	2	..
Steam piping and blowers	15	..	15	12	..	14	11	..	14	9	..	15	6	1	5
Steam valves	13	..	13	7	..	7	7	..	7	9	..	10	5	1	4
Studs	1	..	1	1	..	1	..	..	..	1	..	1	1	..	1
Superheater tubes	2	..	2	4	..	6	2	..	2	4	..	5	2	..	2
Throttle glands	1	..	1	2	..	2	2	..	2	..	..	..	1	..	1
Throttle leaking	1	..	1	2	..	3	1	..	1	1	..	1	..	..	..
Throttle rigging	15	..	16	6	..	6	9	..	9	4	..	4	4	..	4
Trucks, leading, trailing, or tender	10	..	12	5	..	5	5	1	5	3	..	4	11	3	11
Valve gear, eccentrics, and rods	7	..	7	7	..	7	10	1	9	3	..	3	3	..	4
Water glasses	12	..	13	10	..	10	14	1	13	11	..	11	7	..	7
Water-glass fittings	2	..	2	1	..	1	2	..	3	..	..	..	..	..	..
Wheels	1	..	1	1	..	1	1	..	1	2	..	2	1	..	1
Miscellaneous	124	..	127	124	3	126	103	1	106	70	1	68	48	..	50
Total	419	10	439	410	20	429	403	25	466	319	27	373	222	34	227

Locomotives Other Than Steam, and Their Appurtenances

Part or appurtenance which caused accident	Year ended June 30— 1946 Accidents	1946 Killed	1946 Injured	1945 Accidents	1945 Killed	1945 Injured	1944 Accidents	1944 Killed	1944 Injured	1943 Accidents	1943 Killed	1943 Injured	1942 Accidents	1942 Killed	1942 Injured
Brakes and brake rigging	2	..	3	3	..	8	1	..	3	1	..	1	..	..	..
Carburetors	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Couplers	..	..	..	1	..	4	3	..	3	1	..	1	1	..	1
Crank pins and connecting rods	..	..	..	2	..	2	..	..	..	..	..	..	..	..	..
Fires: due to overflowing or leakage of fuel, crank case explosions, back firing, et cetera	4	..	5	6	..	6	4	..	5	3	..	5	3	..	3
Generators and starting devices	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..
Insulation	1	..	1	1	..	1	..	..	..	..	..	..	1	..	1
Pantographs and trolleys	2	..	2	2	1	1	..	..	..	1	..	1	..	..	1
Short circuits	2	..	2	2	..	2	1	..	1	3	..	4	..	..	..
Miscellaneous	27	..	43	12	..	16	8	..	11	5	..	5	3	..	3
Total	38	..	56	29	1	40	17	..	23	15	..	18	9	..	9

point of explosion and 90 ft. forward of the point where the train stopped. Parts of the wreckage were scattered over an area extending to a radius of 751 ft. In the other accident in which the locomotive was hauling a hospital train at an estimated speed of 45 to 50 m.p.h., the force of the explosion broke the front end door hinges; the door was found 437 ft. ahead and 186 ft. to the left of the point of explosion, and parts of the headlight were found from 300 to 400 ft. ahead and from 166 to 190 ft. to the left. The train was brought to a stop in 2,090 ft. by the conductor who applied the brakes from the caboose upon seeing a cloud of black smoke around the locomotive. One employee was killed and one injured in this accident.

One employee was killed and one injured in one of the two explosions that occurred while the locomotives were hauling passenger trains. The locomotive involved in this accident was the second locomotive of a double-header, and the explosion occurred while the train was running at an estimated speed of 65 m.p.h. The train was stopped by the engineer of the leading locomotive about 2,000 ft. from the point of the explosion. Two employees were injured in the other explosion which occurred while the train was running at an estimated speed of 15 to 18 m.p.h. In this instance the two employees were blown from the cab by the force of the explosion, and the train was stopped in a distance of about 1,000 ft. by the conductor by means of the conductor's brake valve.

Four employees were killed and 17 injured in the 11 explosions that occurred on locomotives in freight-train service. One of these accidents caused derailment of the locomotive and tender and derailment of 13 cars, 8 of which were destroyed. The locomotive, tender, and cars were massed within a space of 150 ft. on and adjacent to the track about 250 ft. forward from the point of explosion.

Two employees were killed and one injured in the three explosions that occurred while the locomotives were in charge of engine watchmen. In two instances, in each of which the watchman was killed, the force of the explosions tore the boilers from the running gears. One of these boilers was blown upward and forward and alighted, on a rail of the track upon which the locomotive was standing, 193 ft. from the point of explosion; the rail was broken by the impact, and a depression was made in the roadbed approximately 8 ft. deep. Parts of the wreckage

were scattered in various directions over an area extending to a radius of 900 ft. Electric power service of the city in which the explosion occurred and that of a nearby army camp was disrupted by falling parts which severed the power lines. The other boiler that was torn from the running gear apparently ascended practically vertically, and in falling the boiler back head struck the right main rod and the boiler came to rest in approximately upright position, 12 ft. ahead and 12 ft. to the right of the point of explosion and parellel to the running gear. Parts of the wreckage were scattered in various directions over an area extending to a radius of 272 ft.

Our investigations developed that the absence of normally safe water level was known by one or more employees on one of the locomotives in passenger-train service and on six of the locomotives in freight-train service in advance of occurrence of the explosions, and actions had apparently been taken to increase the rate of water supply to the boilers. One employee was killed and 12 employees were injured in this group of 7 accidents.

In all the foregoing seven instances, working of the locomotives was continued with various throttle openings described as part to full open, which use of steam results in further retardation of restoration of the water level, or depletion of the quantity of water in the boiler, depending upon the extent of working of the locomotive and the rate of water supply. In one case the fuel-oil fire was extinguished by closing the emergency valve in the oil supply line shortly before the accident occurred, but there was no evidence in any other instance that any steps had been taken looking toward extinguishing or dumping the fire or of easing off or closing the throttle to conserve the known inadequate quantity of water in the boiler. One of this group of locomotives in freight-train service, was equipped with a low-water alarm. The alarm sounded about 4½ mi. before the point of accident was reached and continued to sound steadily, for a time estimated as six to eight minutes, until the accident occurred; during this time two applications and releases of the brakes were made in attempts to slush water over the crown sheet and the throttle remained practically full open. It is apparent that in all these instances the innate urge to keep trains moving to avoid delays on the line of road, which is a characteristic of all employees whose duties involve the

Table IV—Number of Locomotives Reported, Inspected, Found Defective, and Ordered Out of Service

Steam Locomotives

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30— 1946	1945	1944	1943	1942	1941
1. Air compressors	1,044	1,054	1,146	968	829	684
2. Arch tubes	27	17	45	50	27	31
3. Ashpans and mechanism	93	81	93	71	80	67
4. Axles	7	11	15	15	2	5
5. Blow-off cocks	388	361	289	291	238	205
6. Boiler checks	526	511	533	503	393	313
7. Boiler shell	462	416	406	377	290	271
8. Brake equipment	2,992	2,755	2,914	2,661	2,382	1,945
9. Cabs, cab windows, and curtains	1,501	1,057	1,169	1,102	1,163	1,087
10. Cab aprons and decks	469	426	381	390	335	307
11. Cab cards	120	91	104	142	131	97
12. Coupling and uncoupling devices	46	57	65	66	70	74
13. Crossheads, guides, pistons, and piston rods	1,941	2,079	2,149	1,961	1,273	858
14. Crown bolts	88	90	105	66	75	97
15. Cylinders, saddles, and steam chests	2,217	1,801	2,133	1,395	1,514	1,332
16. Cylinder cocks and rigging	679	454	624	430	521	438
17. Domes and dome caps	164	187	189	196	112	94
18. Draft gear	536	486	576	599	651	620
19. Draw gear	462	447	515	469	369	347
20. Driving boxes, shoes, wedges, pedestals, braces	1,922	1,803	2,026	2,053	1,743	1,348
21. Firebox sheets	333	319	347	303	255	224
22. Flues	253	260	274	215	178	150
23. Frames, tail pieces, and braces, locomotive	1,003	852	1,019	894	869	863
24. Frames, tender	88	97	126	86	86	83
25. Gages and gage fittings, air	185	151	158	191	193	183
26. Gages and gage fittings, steam	370	353	328	316	263	236
27. Gage cocks	495	449	532	584	497	373
28. Grate shakers and fire doors	555	558	539	492	491	430
29. Handholds	540	527	464	483	378	433
30. Injectors, inoperative	50	41	46	66	47	39
31. Injectors and connections	2,750	2,533	2,867	2,637	2,220	1,882
32. Inspections and tests not made as required	8,885	9,067	9,565	9,037	8,186	7,215
33. Lateral motion	862	977	898	700	498	357
34. Lights, cab and classification	161	167	243	184	131	50
35. Lights, headlight	168	222	268	184	218	190
36. Lubricators and shields	351	306	257	292	234	196
37. Mud rings	238	257	301	256	244	187
38. Packing nuts	691	654	746	669	689	508
39. Packing, piston rod and valve stem	776	845	879	724	738	675
40. Pilots and pilot beams	153	171	193	194	188	142
41. Plugs and studs	262	245	281	259	173	156
42. Reversing gear	482	439	454	452	411	387
43. Rods, main and side, crank pins, and collars	2,581	2,569	3,230	2,798	1,986	1,565
44. Safety valves	72	84	77	74	67	68
45. Sanders	784	658	609	642	738	490
46. Springs and spring rigging	5,195	4,734	4,625	3,583	3,349	2,597
47. Squirt hose	120	98	94	92	67	62
48. Stay bolts	360	351	400	367	272	239
49. Stay bolts broken	268	308	232	247	274	198
50. Steam pipes	551	416	435	414	290	385
51. Steam valves	203	157	161	159	150	110
52. Steps	914	681	872	729	594	555
53. Tanks and tank valves	1,570	1,215	1,400	1,321	1,150	952
54. Telltale holes	60	78	69	78	79	59
55. Throttle and throttle rigging	979	948	948	887	786	688
56. Trucks, engine and trailing	1,261	1,151	1,155	1,020	833	636
57. Trucks,tender	1,101	974	928	900	786	773
58. Valve motion	1,080	991	1,021	998	779	580
59. Washout plugs	740	820	845	685	569	445
60. Train-control equipment	5	2	5	9	7	1
61. Water glasses, fittings, and shields	1,190	1,328	1,323	1,454	1,133	788
62. Wheels	840	899	759	728	664	536
63. Miscellaneous—Signal appliances, badge plates, brakes (hand)	1,332	1,211	1,167	1,142	970	785
Total number of defects	56,541	53,367	56,617	51,350	44,928	37,691
Locomotives reported	41,851	43,019	43,279	43,064	42,951	43,236
Locomotives inspected	101,869	115,979	117,334	116,647	113,451	105,675
Locomotives defective	11,337	11,975	12,710	11,901	10,970	9,570
Percentage of inspected found defective	11	10	11	10	10	9
Locomotives ordered out of service	690	506	630	487	474	560

Locomotives Other Than Steam

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30— 1946	1945	1944	1943	1942	1941
Air compressors	15	14	7	7	13	22
Axles, truck and driving	...	...	...	6	...	5
Batteries	2	...	1	2	1	6
Boilers	11	8	...	1	5	4
Brake equipment	102	114	85	62	86	69
Cabs and cab windows	46	59	40	33	27	45
Cab cards	24	25	21	17	20	24
Cab floors, aprons, and deck plates	72	60	54	31	10	14
Clutches	2	2	1	2	1	...
Controllers, relays, circuit breakers, magnet valves and switch groups	16	18	14	9	12	7
Coupling and uncoupling devices	6	6	3	1	5	2
Current collecting apparatus	9	10	...	1	1	3
Draft gear	18	14	14	15	19	15
Draw gear	3	8	...	2	3	3
Driving boxes, shoes, and wedges	44	29	12	25	16	36
Frames or frame braces	10	12	12	7	5	1
Fuel system	57	45	33	32	81	62
Gages or fittings, air	7	7	6	3	8	3
Gages or fittings, steam	...	...	2	1	...	...
Gears and pinions	...	...	1	4	4	2
Handholds	18	13	6	19	14	12
Inspection and tests not made as required	357	297	278	223	274	243
Insulation and safety devices	12	17	8	4	3	4
Internal-combusion engine defects, parts and appurtenances	145	133	86	50	62	54
Jack shafts	4	6	8	2	1	3
Jumpers and cable connectors	8	9	2	3	1	...
Lateral motion, wheels	18	20	9	10	...	4
Lights, cab and classification	2	...	1	1	5	2

LOCOMOTIVES OTHER THAN STEAM—(*Continued*)

Lights, headlight	...	1	2	2	1	1
Meters, volt and ampere	4	2	2	3	2	...
Motors and generators	15	12	14	14	16	16
Pilots and pilot beams	8	1	2	4	10	12
Plugs and studs	...	1	...	...	...	...
Quills	52	29	18	9	6	...
Rods, main, side, and drive shafts	11	3	10	...	2	4
Sanders	57	50	59	41	57	56
Springs and spring rigging, driving and truck	42	38	44	18	35	58
Steam pipes	1	6	3	1	...	1
Steps, footboards, et cetera	29	28	25	25	21	35
Switches, hand-operated, and fuses	...	7	2	2	2	2
Transformers, resistors, and rheostats	3	...	...	3	3	3
Trucks	52	42	47	22	28	30
Water tanks	1	2	1	4	1	1
Water glasses, fittings, and shields	15	2	4	2	5	1
Warning signal appliances	2	...	2	3	3	4
Wheels	54	46	74	107	43	28
Miscellaneous	31	16	13	16	14	8
Total number of defects	1,385	1,212	1,026	849	926	905
Locomotive units reported	6,616	6,094	5,139	4,351	3,957	3,389
Locomotive units inspected	10,908	9,888	7,711	6,847	6,728	5,558
Locomotive units defective	499	447	378	298	358	319
Percentage inspected found defective	4.6	4.5	4.9	4.4	5	6
Locomotive units ordered out of service	17	16	9	6	12	21

movement of trains, was permitted under the exigencies prevailing to take precedence over the universal safety rule of all railroad companies, applicable to any condition of train or locomotive operation that may arise, to the effect that in case of doubt the safe course shall be taken.

Attention has repeatedly been called in the annual reports of the bureau and in reports on boiler explosions caused by overheating of crown sheets, to the futility of attempting to keep trains moving in the absence of definite knowledge of the presence of safe water level in the boiler and to the necessity of constant vigilance on the part of all whose duties in any way concern the safety of locomotives, whether moving or standing, to maintain the water level at a known height that will protect the crown sheet from overheating. This requires maintenance of the water level so that the height is readily visible in the water glass, reducing the rate of working of the locomotive if, from any cause, water is being used at a rate in excess of that at which it can be supplied to the boiler. Water glasses should be blown out sufficiently often, and the movement of the water therein carefully noted, to insure that the water moves freely. The gage cocks should be tried frequently to check the level in the water glass, but a safe water level should not be assumed if the bottom gage cock seemingly indicates the presence of water if none is visible in the water glass. The lowest indication of any water level indicating device when observed normally should be controlling; in other words, the least favorable should be considered as the correct indication.

Trick means, such as closing the top water-glass cock in attempts to cause the water to ascend in the glass, attempts to slush water over the crown sheet by abruptly varying the speed of the locomotive, or, if the locomotive is standing, attempts to raise the water or slush it over the crown sheet by opening the throttle and repeatedly reversing the locomotive, or assuming that the discharge from the water-glass drain pipe or the discharge from the bottom gage cock indicate sufficient water if it cannot be readily observed in the water glass, only raise false hopes that the crown sheet may not become overheated.

If observation of the water level has been inadvertently overlooked until the level has receded below the lowest reading of the water glass, or proportionately higher if the locomotive is headed upward on an ascending grade, the fire should be dumped or extinguished at once.

One hundred and thirty-eight boiler and appurtenance accidents other than explosions, in which no fatalities occurred, resulted in injuries to 143 employees. This is an increase of five accidents, a decrease of four deaths, and an increase of one injury compared with the preceding year.

* Flues all new or reset. (Superheater flues may be expected.) Necessary repairs to firebox and boiler. Tires turned or new. General repairs to machinery and tender.

Extensions for Flue Removals

Of 1,727 applications requesting extension of time for the removal of flues, 240 cases could not be granted; 52 were granted for shorter periods of time and 58 were granted after defects had been repaired. Sixty-nine applications were canceled and 1,308 were granted for the full period requested.

Amended Rules

In accordance with Section 7 of the Locomotive Inspection Act, recommended changes were incorporated in an order dated January 16, 1946, amending the rules shown:

RULE 106

Safe condition.—(*a*) It must be know before each trip that the brakes on the locomotive and tender are in safe and suitable conditions for service; that the air compressor or compressors are in condition to provde an ample supply of air for the service in which the locomotive is put; that the devices for regulating all pressures are properly performing their functions; that the brake valves work properly in all positions; and that the water has been drained from the air-brake system.

(*b*) Each steam road locomotive built on or after March 1, 1946, shall be equipped with a brake-pipe valve attached to the front of the tender or on the rear of the back cab wall to enable the brakes to be applied in the event the occupants of the cab are, from any cause, prevented from applying the brakes in the usual manner. On locomotives having vestibule cabs the brake pipe valve shall be located adjacent to an exit.

The words EMERGENCY BRAKE VALVE shall be legibly stenciled on the cab near the brake-pipe valve or shall be shown on a badge plate adjacent thereto. That each steam-road locomotive built before March 1, 1946, shall be so equipped the first time said locomotive receives Class 3* or heavier repairs after June 1, 1946, but not later than June 1, 1948.

RULE 153

Feed water tanks.—(*a*) Tanks shall be maintained free from leaks, and in safe and suitable condition for service. Suitable screens must be provided for tank wells or tank hose. Feedwater tanks on road locomotives that take water en route, built on or after March 1, 1946, shall be equipped with a device whereby the height or quantity of water in the tender feedwater tank may be ascertained from the cab or tender deck of the locomotive, which shall be properly maintained. That each steam road locomotive that takes water en route, built before March 1, 1946, shall be so equipped the first time said locomotive receives Class 3* or heavier repairs after June 1, 1946, but not later than June 1, 1948.

RULE 157

Reverse gear.—* * * (*c*) Each steam locomotive used in road service, built on or after March 1, 1946, that has an air-operated power reverse gear shall be equipped with a connection whereby such gear may be operated by steam or by an auxiliary supply of air in case of failure of the main-reservoir air pressure. Each steam locomotive used in road service, built on or before March 1, 1946, that has an air-operated power reverse gear shall be so equipped the first time said locomotive receives Class 3* or heavier repairs after June 1, 1946, but not later than June 1, 1948. If an independent air reservoir is used as the source of auxiliary supply for the reverse gear, it shall be provided with means to automatically prevent loss of pressure in event of failure of the main reservoir air pressure.

(*d*) When steam connections to air-operated power reverse gear are used, the operating-valve handle shall be conveniently located in the cab of the locomotive and so arranged and maintained that in case of air failure steam may be quickly used to operate reverse gear. The operating rod or lever shall be plainly marked and equipped with a handle or wheel of a distinctive design.

Appeals

No formal appeal by any carrier was taken from the decisions of any inspector during the year.

Milwaukee Builds 40-Ft. 6-In.

Welded 50-Ton Box Cars

ABOUT five years ago the Chicago, Milwaukee, St. Paul & Pacific built in its shops at Milwaukee, Wis., 500 50-ton box cars which were described in the December, 1941, *Railway Mechanical Engineer*.. These cars were completely fabricated by welding and comprise practically the largest 50-ft. 6-in. box cars possible to build within the A.A.R. clearance limits. The addition of this equipment raised the Milwaukee's ownership of 50-ft. 6-in. box cars adapted to general commodity loading exclusive of automobiles to slightly under 1,000 cars.

Spot welding door header to side plate

In 1946 the Milwaukee initiated the construction of and has recently completed 750 50-ton, 40-ft. 6-in. box cars at company shops embodying refinements in design and fabricating methods and built well out to the clearance limits so as to give maximum cubic capacity in a car of this length. These cars, designed for high-class commodity loading, will increase the Milwaukee's ownership of 40 ft. 6 in. box cars to practically 24,500 which will go far to meet the demand for additional box cars in Mil-

General Dimensions and Weights of Welded 50-Ton Box Cars Built at Milwaukee Shops

	1941 car (50 ft. 6 in.)	1947 car (40 ft. 6 in.)
Length over striking castings, ft.-in.	51—7⅜	41—7⅜
Inside length, ft.-in.	50—6	40—6
Inside width, ft.-in.	9—6	9—6
Inside height at center, ft.-in.	11— ¼	11— ¼
Inside height at eaves, ft.-in.	10—9	10—9
Distance between truck centers, ft.-in.	40—7⅝	30—7⅝
Width over side sheets, ft.-in.	10—1⅝	10—1⅝
Width over roof sheets, ft.-in.	9—8½	9—8½
Width over side ladders, ft.-in.	10—7⅜	10—7⅜
Heights—top of rail to top of floor, ft.-in.	3—7	3—7
Height—top of rail to running board, ft.-in.	15— ⅝	15— ⅝
Width over door roller housings, ft-in.	10—8	10—8
Side-door opening, ft.-in.	9—6¾ by 6—0	9—6¾ by 6—0
End-door opening, A end, in.	16 by 18½	16 by 18½
Light weight, lb.	48,200	43,500
Load limit, lb.	120,800	125,500
Capacity, cu. ft.	5,157	4,136
Ratio load limit to gross load, per cent	71.5	74.3
Ratio light weight to capacity, lb. per cu. ft.	9.35	10.52

Spot-welding reinforcing clips to the door rail

Partial List of Specialties and Materials on 750 Milwaukee 50-Ton Box Cars

Low-alloy, high-tensile steel:		
Cor-Ten		Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.
N-A-X		Great Lakes Steel Corporation, Detroit, Mich.
Brake beams		Assembled at railroad company shops
Brake hangers, levers, etc.		Schaefer Equipment Company, Pittsburgh, Pa.
Brake-beam supports and bottom-rod guards		Chicago Railway Equipment Company, Chicago
Hand brakes	(375)	W. H. Miner, Inc., Chicago
	(375)	Universal Railway Devices Company, Chicago
AB brakes		Westinghouse Air Brake Company, Wilmerding, Pa.
Couplers and yokes		Buckeye Steel Castings Company, Columbus, Ohio
Draft gears	(250)	Cardwell Westinghouse Company, Chicago
	(250)	W. H. Miner, Inc., Chicago
	(250)	National Malleable & Steel Castings Co., Cleveland, Ohio
Steel doors, 6 ft.		Youngstown Steel Door Company, Chicago
Steel roofs, ends, door fixtures, metal floor plates, etc.		Standard Railway Equipment Company, Hammond, Ind.
Journal box lids (Motor Wheel)		T-Z Railway Equipment Company, Chicago
Car lumber and plywood		Douglas Fir Plywood Association, Tacoma, Wash.
Running boards, longitudinal,		Apex Railway Products Company, Chicago
Side bearings, single roller		A. Stucki Company, Pittsburgh, Pa.
Stabilized trucks, Barber		Standard Car Truck Company, Chicago
Truck sides and bolsters		American Steel Foundries, Chicago
		Buckeye Steel Castings Company, Columbus, Ohio

waukee service and to replace obsolete and worn-out cars which have been dismantled.

According to the table of comparative dimensions it

Side turnover jig—The door rail is applied in this position

Side set-up jig—Side sill being applied

Underframe jig

First erecting operation—Air jacks used in applying sides

will be noted that, aside from the difference of 10 ft. in length, the 1941 and the 1947 cars are much the same. The inside height, width, and side- and end-door openings are identical. The light weight of the 1947 car is 43,500 lb. which gives a load limit of 125,500 lb. with a capacity of 4,136 cu. ft. The ratio of load limit to gross load is 74.3 per cent and the ratio of light weight to cubic capacity is 10.52 lb. per cu. ft., or slightly more in each instance than was the case with the longer 1941 car.

As in the case of the earlier cars, leak-proof side doors of the cars built in 1947 are mounted in rigid steel frames which are welded as units into the car sides and give increased strength at a point where it is greatly needed. There are two-piece car ends and narrow adjoining side pans, also prefabricated and welded into strong structural units. The car floor between the doorways is protected against wear by a perforated steel plate and sealer. Inside lining of plywood in readily renewable panels is applied at the doorways. These panels are 54 in. wide. Individual floor boards may be renewed without disturbing the side lining and easily removable clean-out boards permit thorough blowing out back of the lining at both sides and ends. The position of nailing posts inside of the car is indicated by vertical rows of dashes burned into every other lining board by means of an electric marker.

This car embodies the Milwaukee construction with horizontal-rib side-sheet strips united by electric spot welding. The cars are built primarily of Cor-Ten and N-A-é low-alloy high-strength steel. The principle difference in construction over the earlier box cars is the use of heavier spot-welding equipment and the simplification of some of the assemblies in order to get increased output. The cars were turned out of Milwaukee shops at a rate of 10 a day.

Squaring racks for the car sides

The bottom door sealer

Apprentices and Supervisors*

By W. H. Sagstetter†

THE employment, supervision, and training of apprentices are just as important as the selection, purchase, and proper use of locomotives, cars, and machine tools. The best possible results along these lines can be obtained only by intelligent, long-time planning and the setting-up of continuous programs for many years ahead. If we expect to provide ourselves with well-qualified journeyman mechanics in the years to come, we must be doing something about it today. The same thing is true about future well-qualified supervisors.

A regular apprentice who is indentured today will probably not graduate and become a journeyman mechanic until 1951. Even though, at the time he graduates, he possesses the undeveloped characteristics for leadership in order to become a good supervisor, it may be 1954, or later, before he is sufficiently trained to assume in a creditable manner such duties and responsibilities.

In order to solve the problem of providing ourselves with the best possible mechanics and the best possible supervisors in the future, we must tackle the problem at the beginning by exercising care in the selection of new employees. There should be certain employment entrance standards for applicants for an apprenticeship. We may find it to our advantage to go out after suitable applicants instead of considering only those who come to us. By visiting the high schools and vocational schools along the line and acquainting desirable young men with the opportunities of serving an apprenticeship on the railroad, it is possible now to secure sufficient suitable applicants to fill apprentice vacancies and also to build up a waiting list of qualified applicants. New and higher standards of craftsmanship should be the mutual aim of the railroads and the shop crafts labor organizations. They both benefit.

The Apprentice Ratio

Apprenticeship was almost abolished on many of our American railroads during the depression and also again during World War II. This, of course, is partially responsible for the shortage of qualified, trained journeyman mechanics today. It is important that the full quota of apprentices under the allowed ratio of apprentices to mechanics be maintained. Many mechanical department officers and supervisors as well as some railroad labor leaders and general chairmen have in the past been under the impression that there were at times too many apprentices. This impression was probably formed because there were certain years during which some railroads were not able to absorb immediately all of their graduate apprentices at the time they graduated.

If a survey had been made at any time during the past twenty years or more of the number of men receiving journeyman mechanic rates of pay who had served an apprenticeship, I believe that we would be somewhat surprised at the figures. Such a survey today would prove that we have not had too many apprentices in the past. A proper ratio of apprentices to mechanics should be worked out by agreement and maintained. A number of years ago a ratio of one apprentice to every five mechanics was more or less standard. In recent years the shop crafts organizations have tried through negotiation to reduce this ratio to one apprentice for every 10 mechanics, and in some instances to an even lower ratio.

It is generally assumed that every apprentice who is indentured completes his apprenticeship. This is far from being true. I find that on several of our major railroads, covering a total period of twenty years, approximately only one apprentice out of every three indentured completes his apprenticeship. By applying this fact to any existing ratio of apprentices to mechanics, the average number of apprentices that would graduate each year may easily be determined. For example, applying what we have learned from the past to a ratio of one apprentice to every five mechanics, and for ease in figuring let us use the figures of 20 apprentices to 100 mechanics, an average of approximately only two apprentices per year would be graduated. This number is far from sufficient to offset the losses in the ranks of mechanics caused by retirements, deaths, resignations, promotions, etc. The ratio of apprentices to mechanics should be increased, not decreased.

The actual ratio of apprentices to mechanics is always less than the agreed ratio. For example, an agreed ratio of one apprentice to every six mechanics, actually means a ratio of anywhere between 1 to 6 and 1 to 11. On the basis of this ratio, if there are 11 mechanics in a certain craft, only one apprentice may be employed under the agreed ratio, and the second may not be employed until there are from 12 to 17 mechanics in that craft.

Suit Schedules to Facilities

An apprentice should be given an opportunity to learn as much as possible about all branches of the trade in which he is apprenticed. I believe that instead of having a general shop schedule for each craft on the entire railroad, it is better to work out such schedules for each craft at each point where apprentices are employed, in line with the facilities at each point.

There are many things which an apprentice cannot learn or master by practical experience alone. For this reason a good sound technical training program should also be provided for apprentices. They should be required to conform to a progressive schedule in their technical training. Definite records should be kept on the progress of each apprentice, not only in his technical training but also in connection with his practical shop training.

Our present apprentice training program on the Rio Grande was started July 1, 1936, and continued to function throughout the war without interruption. The program includes all regular, helper, and special apprentices in the maintenance-of-equipment department. Apprentices are employed in the following (nine) crafts: machinist, boilermaker, blacksmith, car builder, sheet-metal worker, electrician, painter, patternmaker, and upholsterer. We have apprentices employed at Denver, Colo., Pueblo, Alamosa, Salida and Grand Junction, and Salt Lake City, Utah.

A shop schedule for each craft, at each point, is followed in moving apprentices from one operation to another. Each apprentice is rated monthly on an individual rating

*From an address before the Pacific Railway Club at Los Angeles, Calif., February 13, 1947.

†Chief mechanical officer, Denver & Rio Grande Western, Denver, Colo.

sheet by the foreman or foremen under whom he worked during the month. He is rated on interest, initiative, industriousness, personal neatness, conduct, ability to learn quickly, craft skill, observance of safety rules, cooperation, and also on the quality and amount of work performed compared with that of the average mechanic. These rating sheets, after being signed by the foreman or foremen concerned, are reviewed by the general foreman, master mechanic, and supervisor of apprentices. They are then placed in the apprentice personal record files.

Technical Training

The program of technical training provides for individual and personal instruction of each apprentice and he is required to qualify on a progressive study schedule during the entire period of his apprenticeship. Records are kept on a monthly basis on the progress of each apprentice. His examinations and drawings are carefully checked, and he receives personal help and instruction from the supervisor of apprentices.

An apprentice is disciplined for failure to comply with the study schedule requirements of his technical training. The discipline rules governing the technical training of apprentices are contained in the shop crafts agreement. I quote them below:

1—An apprentice who fails to maintain the study schedule of requirements of two (2) new examinations each month, becomes delinquent in any month in which he is either one (1) or two (2) examinations behind schedule, and he no longer has a perfect record. However, such apprentice is still considered in good standing and can clear his delinquency by submitting the required number of new examinations to put himself on schedule again.

2—An apprentice who accumulates two (2) uncleared delinquencies (two separate months) is still considered in good standing and can clear his delinquencies by submitting the required number of new examinations to put himself on schedule again.

3—An apprentice who accumulates three (3) uncleared delinquencies (three separate months), is subject to removal from the service after proper investigation is held, as provided for, in conjunction with the Local Committee.

4—An apprentice who removes himself from the service for cause mentioned in paragraph 3, after proper investigation is held, in conjunction with the Local Committee, as provided for, is given one more chance, under the following conditions:

(a) Within fifteen (15) days after removal from the service, such apprentice must personally bring to the officer in charge of the shop point where such apprentice is working, a sufficient number of new examinations to put himself on schedule again and in addition, reworked examinations on all lessons on which such apprentice has previously failed to attain a passing grade. These examinations must be in an unsealed and properly stamped envelope or container, so that the officer in charge may inspect the examinations.

(b) After complying with the requirements of paragraph 4 (a) such apprentice will then be reinstated.

5—If an apprentice accumulates three uncleared delinquencies a second time, he will be given an investigation as provided for in System Federation No. 10 Agreement, in conjunction with the Local Committee, and if it is proven that such apprentice was three months delinquent a second time, he will be dismissed as an apprentice.

6—In connection with the application of paragraphs numbered 3, 4, and 5, it is understood that an apprentice may be excused for failure to live up to the study schedule requirements of his technical training on account of sickness or any other legitimate cause beyond his control. The Apprentice Instructor, in conjunction with the Local Committee, will investigate such cases and will make their recommendations as to whether an apprentice should be excused.

7—An apprentice who is delinquent in his studies when completing his apprenticeship, will not receive his diploma until after he has cleared his record.

The above is quoted from Rule 34 (u) of the current agreement with System Federation No. 10, Railway Employees Department, Mechanical Section thereof, A.F. of L. We have received splendid cooperation from the shop crafts organizations in connection with our apprentice training program.

The technical training for apprentices includes fundamentals which are common to all mechanical-department craft work, such as shop mathematics, reading blueprints, freehand sketching, layout work, safety, etc. Following the fundamental part of the program, the training is then specialized for each individual craft on the technique of craft work. Technical training is applied equally to all crafts. For example, we have but one upholsterer apprentice on the Rio Grande, yet he is assured the same kind and amount of training in his craft as are the apprentices in crafts in which the majority are employed.

Much has been written and said in the last few years to the effect that the railroads in general did not appreciate college men and that the industry as a whole did not absorb its proportion of these young men with higher education. Hundreds of college graduates are absorbed yearly by the railroads. There are plenty of opportunities in the various departments on our railroads today for college-trained men, providing they are willing to start at the bottom in order to acquire the necessary experience to be promoted to higher positions.

Apprentice Clubs

Our apprentice-training program has been supplemented by apprentice clubs. The apprentices elect their own officers and conduct their own meetings. These club meetings afford each apprentice an opportunity of broadening his knowledge of railroading in general, how to conduct meetings, take part in discussions, etc. The principal speakers at these meetings are usually officers and supervisors from different departments, and sometimes representatives of railway supply companies. Demonstrations are sometimes given and use is made of motion pictures and slides. The meetings have been of such interest that many of our supervisors and mechanics have attended. The apprentice-club meetings were discontinued during the war, but we have started them again.

We started with 110 apprentices. At the end of ten year years at total of 1129 apprentices were indentured. Of this number 335 completed their apprenticeships, 358 resigned, 131 were dropped from service, one died of natural causes and four were killed in World War II, 23 were disqualified during their probationary period for lack of aptitude to learn a trade, a total of 15 were dismissed for failure to comply with the study schedule requirements of their technical training, and 11 were dismissed for other reasons. At the end of the ten-year period 70 apprentices were still in military service; one on leave of absence to take advantage of the educational provisions of the G. I. Bill of Rights; and 180 were still working as apprentices in various stages of their apprenticeships. I want to emphasize the importance of keeping accurate records. They are essential to a clearer understanding of the whole problem.

The Training Supervisors Need

Training in the fundamentals of supervision should be given or made available to each supervisor. With such training, a supervisor can do a better job in training an understudy than he can without it. The problem of training supervisors on a railroad is more difficult than in most other industries, because supervisors are scattered over the entire territory which a railroad serves. In a large industrial plant having many thousands of employees at one place, it is easy to call a meeting of supervisors for a training session of some kind, or to outline some new plan or policy. This is not practical on a railroad, especially

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Diesel Crankcase Explosion

Piston-ring leaks not the only cause—Hot bearings in crankcase may produce overheated metal which in turn ignites accumulated gases in the crankcase

THE Interstate Commerce Commission on February 7 issued the following report on an explosion in the crankcase of an engine of one unit of a Diesel-electric locomotive which occurred on the Missouri Pacific near Holland, Ark., on January 2, 1947, about 7:45 p. m. The unit, 503-A, together with units 503-B, 511-B, and 509-A, was hauling a freight train at a speed of 40 m.p.h. The brakeman was seriously injured.

Description of Accident

Locomotive 503, operating in multiple control with Diesel-Electric unit 503-A in the lead, departed from North Little Rock, Ark., January 2, 1947, at 7:10 p.m., hauling an extra northbound freight train en route to Poplar Bluff, Mo. The train consisted of one loaded and 121 empty cars, 2,694 tons. The rating of the locomotive on this district is 12,000 tons.

About 7:35 p.m. approximately 10 miles north of North Little Rock, while the train was running at a speed of 45 m.p.h., Fireman W. R. McGuire left the operator's cab and went back to make examination of the units. When he entered the engine compartment of unit 503-A, smoke was coming out around the valve covers on the engine. He took the engine off the line and closed it down and closed the fuel-pump switch and almost immediately a light explosion occurred in the crankcase, blowing off one and loosening two of the valve covers and smoke started coming out of the engine so badly that he opened the end door leading into unit 503-B. When Engineman W. E. Stackhouse heard the explosion he asked Brakeman R. J. Crawford to go back and find out what happened. Brakeman Crawford met the fireman and they returned to the cab and informed the engineer of the occurrence and then returned to complete inspection of the other units. About 7:45 p.m. while train was running at a speed of 40 m.p.h., near Holland, a distance of 16 miles from North Little Rock, another explosion occurred in the crankcase, which blew off all the valve covers and forced eight inspection covers out of place. The explosion set fire to the oil in the crankcase. Brakeman Crawford was standing in the engine compartment on the right side of the engine near the front and the fireman was on the right side walking toward the rear. The engineman brought the train to a stop at Holland after hearing the explosion.

The force of the explosion threw Brakeman Crawford toward the rear of the engine which was on fire all around. Fireman McGuire assisted him into unit 503-B and he continued on through to 509-A which was the rear unit. The engineman and fireman extinguished the fire with the fire extinguishers, then the engineman went to a telephone and notified the dispatcher. Brakeman Crawford received first-degree burns on his face and shock to his body. He continued on the locomotive to Beebe, Ark., which is 14 miles north of Holland, and returned to Little Rock on train No. 225, arriving at 10:03 p.m. He was met by a trainmaster who took him to the Missouri Pacific Hospital for medical attention.

The locomotive proceeded with the train to Poplar Bluff, Mo., where it was turned to put unit 509-A in the lead, then proceeded to Dupo, Ill., and unit 503-A was sent to St. Louis, Mo., for repairs.

Unit 503-A was built by the Electro-Motive Corporation at LaGrange, Ill., in January, 1944. Motive power was supplied by one 1,350-hp. Diesel-electric power plant, operation of which was normally controlled from the leading unit; it was equipped with a control station located in the engine room which afforded local control for the equipment in the unit. The unit had made 282,950 miles since new. The engine bearings, liners, pistons and piston rings were renewed March 15, 1946, and the unit had made approximately 85,000 miles since that time.

Parts Involved in the Accident

The No. 1, 2, and 3 main journal bearings of the Diesel engine crankshaft and the No. 1 and 2 crank pins were cut and scored and had been very hot.

The No. 1 and No. 3 main-bearing shells had apparently been previously badly worn and each was broken in several pieces. The No. 2 main-bearing shells were intact but had been turning with the crankshaft as indicated by the condition of the tangs of the shells which are provided to prevent the shells from turning.

The connecting-rod bearing shells had been very hot and had rough bearing surfaces; the connecting-rod ends had also been hot as shown by their discoloration.

The condition of the main bearing shells was such as to prevent proper flow of lubricating oil from the oil pump through the oil line connections in the tops of the main bearings to the crankshaft and thence to the oil holes in the crankshaft and connecting-rod journals provided for proper distribution of lubrication. This lack of adequate lubrication resulted in overheating sufficient to ignite the vapor in crankcase and cause the explosion.

Inspection and Repair Reports

The last annual inspection was made at Dupo, Ill., on October 11, 1946. The last monthly inspection was made at Dupo on December 10, 1946.

Daily inspection and repair reports from Texarkana, Ark., Little Rock, Ark., Poplar Bluff, Mo., and Dupo, from December 1, 1946, to January 2, 1947, were examined and the following items were found reported in connection with engine irregularities:

December 2, 1946, North Little Rock, Engineman O. O. Paterson: "A" unit used lots of water. December 8, 1946, Dupo, Engineman Wagner: Making too much black smoke right side. No. 15 cylinder rings renewed by Mechanic Siles. December 13, 1946, North Little Rock, Engineman Owens: "A" unit is smoking bad. December 21, 1946, Dupo, Mechanic Dunlap: No. 8 and 10 cylinders not firing, have cold stack. January 1, 1947, North Little Rock, Engineman Steed: Had explosion "A" unit valve cover plate blown off.

The last mentioned inspection and repair report was made in connection with a crankcase explosion at Beebe, Ark., 32 miles from North Little Rock, that occurred

the day preceding the accident which is the subject of this report. Following this explosion, which caused four hours delay to the train and lesser delays to two other trains, the unit was towed to North Little Rock. The repairs made at North Little Rock were described by the mechanic who performed the work as follows: "I made a compression test and did not find any trouble, only bad rings on No. 13 and 14 cylinders. I renewed the rings on No. 14 cylinder. Did not locate any blow or trouble in the crankcase. All other cylinders made good compression test."

Discussion

Apparently it was the opinion of those responsible for maintenance of the unit that the crankcase explosion which occurred on January 1 (one day before the accident) was caused by piston blow by and new rings were applied to the piston of one cylinder in attempt to improve the compression. Blow by, which is readily determinable by compression tests, is only one of the various causes of crankcase explosions, and when blow by is found and remedial action taken it should not be assumed that adequate correction of the cause of explosion has been accomplished. Sufficient inspection should be made of all parts which, through irregularities in condition or functioning, may be the cause of undue heat. Had this been done no doubt the wear in the Nos. 1 and 3 main bearing shells and the turning of the No. 2 shells with the crankshaft would have been found and proper repairs would have averted the January 2 explosion.

The engine was not in operation at the time of the explosion but it is not uncommon for such explosions to occur after the engine is shut down and before the overheated parts have cooled sufficiently to avoid ignition of the vapor in the crank case. When the engine is shut down entry of air into the crankcase affects the vapor mixture to such extent as to change the explosive characteristics and ignition may occur without further generation of heat. It is, therefore, advisable for attendants or others present to depart promptly from close proximity to any engine that has been shut down because of incipient crankcase explosions or excessive overheating until some cooling has occurred.

Cause of the Accident

The report of the Commission concluded "that this accident was caused by a crankcase explosion due to overheated connecting-rod bearings caused by the condition of crankshaft bearings which resulted in interference with proper lubrication."

Apprentices and Supervisors

(*Continued from page 177*)

the larger ones. I believe that a practical supervision training program can be worked out on any railroad.

Many first-line supervisors are responsible for the kind of employees that enter the service. These, as well as any other supervisors who are responsible for employing new men, should be trained to the realization that most any new employee entering service may, if he passes his probationary period, remain in the employ of the railroad until he retires or dies. They should also be trained to the realization that some of these new employees will probably be supervisors, officers, and executives some day.

It should be the responsibilty of every supervisor, from the top all the way down the line, to train, if at all possible, one or more understudies. I believe that this is one of the greatest weaknesses of present-day supervision. Some supervisors have the mistaken idea that if a supervisor trains a good understudy that the understudy may "bump" him out of his job. While this may be possible, it is highly improbable. Nothing will help to develop a supervisor more than training an understudy.

The Rio Grande Program

Several years ago we inaugurated a supervision training program based on the conference method. Supervisors and selected understudies from various departments on the line were brought to Denver in groups of 20 to 22 for three full-day sessions in the conference room of the general office building. The program was designed and conducted by the personnel department, under the guidance of our chief of personnel.

The training in the conferences included such subjects as the history of the Rio Grande; its present physical property; ownership; the responsibilities of management and supervision; a summary of revenues and expenses; the analysis of a supervisor's duties and the desirable ends he is expected to accomplish; the selection and training of understudies; the problems of handling men; starting new employees out right; discipline; safety; value of courtesy; personal appearance; good housekeeping; and employees' suggestion plan. Probably none of these is more important in the present-day railroad than labor relations, and this subject is something of which every supervisor from the lowest to the highest must have a good working knowledge. On how many railroads do all the supervisors, including car yard foremen, assistant trainmasters, chief dispatchers, bridge-and-building foremen, station agents, and traffic-department agents, have an opportunity to meet and discuss their problems with the general officers? Under this supervision training program, our supervisors had an opportunity to meet company officials and to learn about some of their problems and the important role supervision plays in the solution of those problems.

During each three-day conference, talks were made by some of our general officers and heads of departments. After each talk, supervisors were invited to ask questions, and in all the conferences I attended, they were not a bit bashful about doing this. Motion pictures about the Rio Grande and its operations were shown to each conference group in our own projection room in the general offices. Each group was also taken on a tour of the general office building. For many supervisors, it was the first time that they had an opportunity of visiting the general offices and of becoming acquainted with supervisors in other departments located at other points along the line.

This program was discontinued when it no longer became possible to secure suitable hotel accommodations, and another supervision program was started in July of last year. Under the present program, supervision letters are sent out under personal cover semi-monthly to executives, officers, and supervisors in all departments, from section foremen on up. These letters are designed to be educational and instructive. For example, supervisors are kept informed about our operating revenues, operating expenses, and how we stand each month.

Meetings are conducted at various points on the line. Supervisors at the smaller outside points are also contacted individually by the head of the personnel department or his assistant.

The power of suggestion is a strong influence in our lives. Our present program makes it possible to present pertinent thoughts twice a month to all of our supervisors at the same time. We want our supervisors to realize that they are a part of management. Every supervisor represents management to the employees under his jurisdiction.

EDITORIALS

Keeping Freight Trains Moving

At a meeting of the Pacific Railway Club in Sacramento, Calif., last fall, the subject of freight train movement was considered from a number of different viewpoints and, speaking for the mechanical department, E. T. Cuyler, assistant superintendent of motive power, Western Pacific, said, "One of the most important parts played in keeping freight-train moving is the responsibility that rests on the mechanical department to see that the equipment used is in first class condition; this includes rolling stock and motive power. Failure of any of this equipment means serious delays in shipments, which results in disgruntled shippers and loss of business."

Pursuing the subject further, and particularly as relates to car equipment, Mr. Cuyler referred to the prevalence of hot boxes as the greatest single source of train delays. Unquestionably one of the most serious handicaps has been the difficulty in securing good waste and bearing metal for brasses, and the shortage of labor and indifferent attitude of some workmen make proper inspection and oiling of equipment more of a theoretical objective than a practical accomplishment.

Another point emphasized by Mr. Cuyler relates to the proper loading of cars to prevent shifting and excessive weights on axles which cause journals to run hot. The answer to this problem, although generally appreciated, is no less difficult to make 100 per cent effective, namely, the checking of loads at originating terminals to make sure that shippers are loading cars properly. With cars lubricated, maintained and loaded in accordance with the A. A. R. rules, there should be no real need for inspection at intermediate terminals, sometimes spaced only 100 miles apart, and more and more railroad men are coming to the opinion that, if freight shipments are to be speeded up, the cars should go at least 1,000 miles before requiring any attention.

Mr. Cuyler said that the proper care and maintenance of locomotives is of course a fundamental consideration and locomotives must be serviced and ready before train departure time to avoid any delay in keeping freight trains rolling. All delays in getting locomotives ready for their trains, or any locomotive failure enroute with the train, disrupts operation, causes unnecessary loss of time and expense and is especially serious in the case of single-track railroads. Adequate locomotive maintenance requires the right kind of facilities, personnel and organization.

Lack of any one of these three factors will adversely affect mechanical-department performance in terms of train movement and, while adequate mechanical facilities are of the utmost importance, probably the greatest need at the present time is for the selection and training of mechanical forces in correctly performing details of their work and, by some means inducing all to work together as a team in achieving the major railroad objective of increasing the mileage which equipment, both cars and locomotives, can safely and economically make without intermediate inspection and repairs.

Have Train Radio Applications Lagged?

Tentative rules and regulations governing the application and use of radio for train communications were issued by the Federal Communications Commission on November 15, 1945. At the present time, there are 24 railroads holding radio authorizations and a total of 633 radio units have been authorized. The value of the railroad channel assignments has been estimated to be about $12,000,000 as measured by its potential worth to private operating companies in the communications field, and it is felt by some that the railroads should be doing more with this grant if they are to avoid criticism from other assignees who would like to have more channel space.

Before such criticism can become valid, it is necessary that recognition be given to what has been done and what factors control railroad applications. First, it must be remembered that radio service was actually first made available for use on other than experimental frequencies on December 31, 1945. Acting upon the first application for railroad radio authorization submitted pursuant to the establishment of Rules and Regulations Governing Railroad Radio Service, the Federal Communications Commission, on February 27, 1946, granted a construction permit to the Denver & Rio Grande Western for 32 new mobile units as train (end-to-end) stations.

The next problem which confronted prospective railroad users was the difficulty of obtaining radio sets or parts to make them, and it was not until June 1, 1946, that the railroads were assured that persons operating radio sets would not have to carry an operator's license. It still remains with the railroads to determine how best to use train communication and to evaluate the respective advantages of induction and space radio types of such communication.

The highest hurdle—still to be jumped—is the matter

of power supply. This is simple for wayside stations and not too difficult on locomotives, but it involves real difficulties on cabooses. It seems quite generally agreed that all sets should be supplied with 117-volt, 60-cycle, a.c. power. This may be supplied directly on cabooses by internal-combustion engines driving generators. Diesel engines are finding favor for this purpose. It can be supplied directly on steam locomotives by a special turbine-generator set. It can be supplied indirectly on steam or Diesel locomotives or on cabooses equipped with axle generators by means of rotary converters, motor-generators or vibrating inverters. Of these the rotary converters seem to have found the greatest favor. Vibrating inverters appear to have unrealized potentialities. Some operators prefer to fulfill all of the radio set requirements by means of dynamotors operating from 32- or 64-volt, d.c. power sources.

Insofar as radio is concerned, these power-supply requirements are, for the most part, dependability and as much standardization as is practicable. The overshadowing problem is caboose lighting. For years, the railroads have been afraid that if they put power supply units on cabooses, they will be expected to equip all cabooses with electric lights.

These several factors have caused most railroads to go slowly. Some have scarcely moved at all, preferring to let George do it, and then to reap the benefits of his experience. This is probably a short-sighted policy, since it does not contribute to the specific requirements of that particular road and does not contribute to the quality and speed of the whole development. It is evident that early progress must of necessity be slow, and it seems equally evident that all railroads should shoulder a share of the responsibility.

Prize Competition Will Close on May 1

In February this publication offered three sets of two prizes each for the best papers on each of three questions pertaining to present problems of the mechanical department. The first prize in each case is $250 and the second $125. The papers must be submitted on or before May 1—considerably less than a month from the time this paper reaches you.

Several early entries are already in. Others, we know, are under preparation. Do not forget the closing date—May 1, 1947.

If you missed the original announcement and would like to submit a paper of not to exceed 2,000 words on one or each of the three questions, there is still time. Again, here are the questions:

1. What is the problem of outstanding importance with respect to the maintenance and utilization of locomotives and what do you consider the best way to meet it? The following phases are suggestive only: Maximum utilization of steam locomotives. Maintenance policies and methods for Diesel locomotives. Shop and terminal facilities for either or both types of motive power.

2. The car department has come through the war facing some new problems and some old problems which now appear in much aggravated form. What do you think is the most important of these problems and what ought to be done about it? They may arise from the higher standards of comfort and convenience and the faster schedules to which today's passenger-train operation must adhere. There are also plenty of them associated with building up and maintaining an adequate supply of freight cars capable of moving the traffic safely and satisfactorily.

3. More than ever before intense operations under war conditions threw into striking relief the strategic importance of men in supervisory positions in building morale and securing greater efficiency from the forces under their direction. Incidentally, the same thing was true of all industry. If the railroads are successfully to meet the severe competition with which they are now threatened, every possible effort should be made to secure and maintain a high degree of morale and efficient operation. What can be done better to equip and strengthen the hands of men in supervisory positions to enable them to function more effectively?

Freight-Car Retirement Program

One of the many questions concerning the repair and maintenance of freight cars that today confronts car departments is the development of a sound program for retiring and rebuilding freight rolling stock. Such a program is necssary if overall car costs are to be kept to a minimum; it should include procedures for determining the point at which it becomes cheaper to rebuild a car than to continue hand-to-mouth maintenance, and a means for drawing the line between when a car should be rebuilt or be replaced. The mere fact that a car can be repaired or rebuilt indefinitely and still run is not proof that such a measure is economically justifiable.

Not even at the present time can the absence of such

a retirement program be justified. While it may be argued that the existing freight-car shortage necessitates giving first consideration to making the maximum number of cars available for service, it does not follow that a long-range program should not be in effect and adhered to insofar as present conditions permit. There is even today some leeway in at least that phase of the subject concerning the desirability of rebuilding rather than continued patch-up work on the large number of over-age cars that are now in service and seem likely to have to remain so for some time to come. Facts and figures should be available to enable an intelligent investigation to be made of the savings that might be attained through the complete rebuilding of these cars. It is also true that the present use of a sound procedure for determining when to rebuild and when to scrap cars would be valuable when the time comes that new rolling stock is available in sufficient quantities to enable the railroads to retire some of their poorest equipment. The facts that would be learned from following such a procedure now should prove to be a great help in the future in selecting for retirement those cars which most deserve scrapping.

A complete retirement program will have to include factors other than repairs. The adaptability of the design of the car to the business at hand, the volume trend of the lading to which the car is suited, and the operating advantages or disadvantages of the car are some of these factors. But the effect of repair cost on the disposition that is to be made of a car is a large and important effect. It is not the whole picture, but it is a big enough portion of it to justify a careful study and proper correlation with other considerations involved in attaining a sensible, economical freight-car retirement program.

Journal-Box Conditions Require Further Attention

In spite of many years of more or less intensive study of the subject, railway journal-box conditions, particularly as related to packing waste and oil, undoubtedly require further competent attention in the interest of reliable performance, as well as economical but effective maintenance. Many practical railway carmen agree with the lubrication committee findings, reported at the annual meeting of the Car Department Officers' Association in Chicago last Fall, that present A. A. R. specifications for journal-box packing waste are too broad and cover a wider range of quality than desirable if railroads are to secure the better waste required for improved lubrication results. In all probability no specifications for waste could be adopted by the A. A. R. which would meet universal approval, but the need for finding some means of raising the standard of journal-box waste generally used by all roads seems apparent.

Similarly, strong statements in the report regarding the inadequacy of present car oil struck a responsive chord and elicited favorable comments. Too much of the car oil now used in interchange freight cars is unsuited to hot summer or severe winter lubrication. Car oils have been developed which lubricate satisfactorily in summer and yet remain fluid at slightly below zero and, when they eventually congeal, do not become sticky and cause the packing to roll, with attendant interrupted oil flow and practical certainty of hot boxes developing. Revised specifications designed to assure the use of improved modern oils are suggested and particular attention is required to this matter since the best waste obtainable will not produce the desired results if an inferior oil is used.

With regard to waste accumulations which eventually work under the brasses and cause hot boxes, one railroad lubrication authority makes an interesting distinction between waste grabs and waste wipes which are due to different causes and hence require different preventive steps to minimize their occurrence. By this theory, wipes consist chiefly of lint and shredded materials, and of individual shorts that have become detached from the main packing body; then by the rotation of the journal those materials are carried up against the edge of the bearing, creep in between the bearing and the journal, and by swabbing away the oil in the affected area, cause heating. Wipes are usually cumulative in that the particles of which they are composed are drawn up individually, and it may take some time for the accumulation to build up to a size sufficiently large to be dangerous; in fact, many of the small ones are ground out, the only apparent evidence of their presence being a lightly over-temperature bearing. This condition is seriously prevalent in cold weather, particularly if the oil has such characteristics that it becomes sticky upon congealing; it is much worse if the waste contains lint, fuzz and shorts.

A waste grab, on the other hand, consists of a portion of the body packing that has become wholly or partially detached, being carried up against the edge of the bearing; or it may be caused by rolling or an otherwise serious disturbance of the body packing, also leaning against the edge of the bearing. With either of these conditions, any cocking or jumping of the bearing permits the waste to creep in, causing a grab. Like the wipe, poor unsuitable wastes are the major causes and the remedy is to use a waste as free as practicable from lint and shorts which will stay in place in the journal box. It will be necessary to pay some premium in price for this type of waste but the added cost will be a profitable investment.

Other features of the committee report which was ordered referred to the A. A. R. Lubrication Committee for appropriate action included strong recommendation of journal-box packing retainers to hold packing positively in place, effective dust guards to keep dirt and moisture from entering at the rear of journal boxes and the development of improved journal-box lids to perform the same function at the front of boxes.

With the Car Foremen and Inspectors

Meaning of the

Interchange Rule Changes

By R. W. Hollon*

Unofficial interpretation at Car Foremen's Association of Chicago meeting in February throws light on reasons for the changes and helps to clarify their meaning

IN presenting the changes in the 1947 Code of Interchange Rules, I would prefer to direct attention to the rule changes, stating briefly the requirements and as I interpret it, the intent of the rule and withhold questions until all of the rule changes have been covered. I believe by directing attention to the various changes and giving a short explanation with respect to those changes, particularly the more important ones, we will better serve the purpose of this meeting here tonight, rather than to have a prolonged discussion of only a few of the rules. As you entered the hall, you were handed a paper, which lists in rule order, all of the changes, including those in the supplements. In order that we may have time for questions and discussion on the various new requirements placed in the rules this year, I will not attempt to refer to all of the changes listed, particularly those included in Supplement 1 and 2 or those having to do with rule or paragraph references only. Please bear in mind any explanation with respect to requirements or intent of these rules, represents only my interpretation of said rules, and in their application you should be governed by instructions issued by your respective companies.

Rule 2

New Par. (d)—Page 12—This is a new section, inserted in place of the last paragraph of Sec. (b), prohibiting the acceptance, in interchange, of cars, loaded or empty, equipped with engines or heaters using as fuel inflammable liquids or gases having a flash point 80 deg. F., (open cup), or lower, for heating, lighting or refrigeration, except:

1. Refrigerator cars containing portable heaters using methol alchohol or substantially similar liquids as fuel, having flash point not below 60 deg. F. (open cup), are acceptable in interchange, provided such heaters comply with requirements specified in Sect. L, of the A. A. R. Manual, with respect to construction and installation of heaters. However, if receiving line has restrictions against use of such heaters, receiving line may remove them and substitute an acceptable heater.

2. Refrigerator cars equipped with heaters using inflammable petroleum gas may, at option of receiving line, be rejected in interchange unless the fuel tanks have been removed. However, receiving line may, if it so elects, accept such cars with fuel tanks in place, provided the complete installation complies with A. A. R. requirements as specified in Section L of the A. A. R. Manual and cars are placarded "Propane Gas Heater". This rule was modified upon request of the General Committee as a safety measure and to comply with certain local regulations which restrict or prohibit the use of propane and butane gas or fuel for heaters in refrigerator cars.

* Mechanical inspector, Chicago, Burlington & Quincy.

Rule 3

Par. (a) (1-b)—and note following modified and new paragraph (a 1-c) added advancing to standard the A. A. R. four-position slow-release pressure-retaining valve, and making mandatory, effective August 1, 1947, the application of this type valve on all cars built new or rebuilt, and on cars equipped with AB type brakes in place of K-type brakes, on and after this date.

Effective dates with respect to metal badge plates, bottom rod and brake-beam safety supports, braking power, and former standard couplers extended to January 1, 1948. A new note following par. (b-8) authorizes handling line to apply bottom rod and brake-beam safety supports to foreign cars not so equipped, or with supports missing, at car owner's expense.

New Par. (b) (11)—Added with respect to brake steps, if used on cars built new or rebuilt on or after April 1, 1947; such steps must comply with the specifications for brake steps other than wood adopted in 1946, as specified in Par. (7), Sec. (r), of this rule.

Par. (r-6)—Modified, new Par. (r-7) and Note 1 added, Note 2 modified and, specifications for running boards, other than wood, revised to conform to I. C. C. requirements adopted as standard in 1943, and revised 1946. This rule now requires that metal running boards must be applied to box or other roofed cars, (including "LO" hopper cars) built new and to cars of other types rebuilt, on which a new metal roof is applied, and to tank cars built new or where a new or secondhand tank is applied on and after April 1, 1947, which shall comply with the revised specifications. Dome steps and dome platforms for tank cars are classed in the same category as tank car running boards and must therefore conform with these requirements. Specifications for metal running boards and foot boards, other than wood, have been modified to include metal brake steps on box and other roofed cars, metal dome steps, dome platforms and running boards on tank cars.

(t-3-d)—Former Note 1 was modified and relocated as new Par. (3-d) to provide certain requirements to determine whether or not secondhand truck sides are suitable for reapplication i.e., truck sides when removed from service must be placed in furnace and heated to a temperature of approximately 750 deg. F., following which careful inspection must be made. Frames of "U" section design cast in 1926 or prior thereto and all "T" or "L" section frames having any of the defects listed in Sec. (t) (3-c), i.e., cracks, fractures, excessive wear, corrosion or porosity, or welds not performed and marked in accordance with Rule 23 requirements, or otherwise unsuitable for reapplication must be immediately destroyed, except frames of "U" section cast in 1926 or prior thereto having worn surfaces or cracks within the shaded area shown in Fig. 14 of Rule 23 may be restored in accordance with provisions of Rule 23.

(t) (3-f)—New paragraph added which will prohibit, under all cars, effective January 1, 1949, cast steel truck side frames, to which repair patches or reinforcing plates have been applied.

Sec. (w) (2)—Date cast reference eliminated; cast iron wheels, of less than nominal weight, prohibited on all cars.

Second note following Sec. (w) (2)—Modified to bring up to date, by including as additional exceptions the approved type geared hand brake, defect-card receptacle and bottom-rod and brake-beam safety supports not being required on industrial or other cars not intended for interchange service, when moving on their own wheels.

Inter. 1 and 2—Modified, insofar as they relate to AAR 201-A-35 or 201-A-35-W tank cars, to show first and subsequent retests for tanks and safety valves at intervals of ten years instead of five years as at present; also to correct the pounds per square inch as shown in table in Inter. 2 for Class 103-C tank safety valves to 45, instead of 60 lb., to harmonize with I.C.C. regulations.

Rule 4

Note following par. (3) of Sec. (f)—Modified to clarify intent metal side and end sheets are also cardable when associated with cardable side and end sills, as well as cardable posts, stakes, braces and top chord angles.

Sec. (g) (1)—Modified, to clarify intent that if end sill is damaged in connection with other associated unfair usage damage, repairs to end sill, whether on or off car, is also handling line responsibility.

Sec. (g) (2)—Modified to provide specified limit of responsibility for damage to full length side sills. Old rule applied to the short side sills only, i.e., those extending from bolster to end sill, which were cardable if flange or web was bent in excess of 2½ in. In the new rule both flange and web must be bent in excess of 2½ in. to be cardable.

Rule 9

Modified, to require that billing repair card must show wheel stenciling on car when other than cast-iron wheels are removed or applied. This information is necessary for billing purposes.

For journal-box lids, repair card must show in addition to new or secondhand, kind and Rule 101 Item number, kind may be designated by symbols P. S., M1 or Comp.

Reference to spliced air hose eliminated because application of such hose was prohibited January 1, 1946. New AAR Standard air hose must be applied to permit charge.

Rule 10

Second paragraph modified to provide for measurement of multiple-wear wrought-steel wheels by use of the A. A. R. Standard steel wheel gage or approved equivalent, to conform to similar requirement in Rule 98.

Rule 17

Inter. (c-2). Revised to provide that substitution of A. A. R. standard couplers and A. A. R. standard yokes for Non-A. A. R. standard couplers and Non-A. A. R. standard yokes does not constitute improper repairs, and that any undamaged Non-A. A. R. couplers bodies, yokes, radial-butt castings, keys and pins, removed due to such substitutions, shall be reported to car owner for disposition, and if owner does not desire such parts returned at his expense, such material shall be treated as scrap. Investigation developed that only a small number of radial design couplers with (5) Type D head were manufactured and that none were made with Type E heads, also that manufacture of radial-butt couplers was discontinued a number of years ago, therefore it was decided that radial-butt couplers, yokes and parts should be classified as non-A. A. R. and rules revised accordingly to reduce credit for such secondhand items to scrap value instead of on the basis of 75 per cent of value new. This necessitated changes in Rule 101, Item 121-A, Rule 104, first and second paragraphs by eliminating reference to radial design couplers and radial butt castings also new last sentence added covering charge and credit for radial design Type D coupler bodies and radial butt castings.

Rule 18

New Par. (f)—Added which specifies a definite wear limit of 5/16 in. for horizontal coupler draft keys, so that keys will be renewed before they fail entirely. This limit was suggested as it brings the condemning limit within the range where the key can be satisfactorily reclaimed by the reforging method.

Rule 23

Following changes recommended by the Committee on Car Construction and approved by letter ballot.

Sec. A—Par. 6—Recording pyrometers preferred for measuring temperature of furnace.

Sec. B—Notes added to coupler items referring to Section C, covering special welding regulations and limitations for couplers and cast-steel yokes. New items added prohibiting welding forged-steel horizontal coupler yokes and coupler draft keys. Item of Truck Sides, cast steel, revised to prohibit the welding of cracks and fractures outside of the shaded area shown in Fig. 14, in U section design cast-steel truck sides cast in 1926 or prior thereto. Reason for this is that A. A. R. Specifications covering cast-steel side frames were first issued in 1926 and since that time new designs of side frames have been subjected to both dynamic and static tests, hence welding of cast-steel truck sides cast in 1926 and prior thereto has been restricted with a view of eliminating such truck sides from service as a safety measure.

Sec. c—Heading of this section has been changed from "Emergency" to Special Welding Regulations and Limitations for Couplers and Cast Steel Yokes and Par. (gi-8) (c-3) (c-4) and Interpretation (1) modified.

Additional Freight Car Rules

Rule 32.—Note following Sec. (10k)—Modified to clarify intent that any damage due to use of open flame to facilitate unloading is handling-line responsibility and last paragraph revised clearly to indicate paint damage in spots is cardable when there is other cardable fire damage on car.

Rule 37.—This is a new rule which makes handling line responsible for securement of portable tanks to anchorage on multiple unit tank cars.

Rule 57.—Revised to its former requirements that A. A. R. Standard 1⅜-in. air brake hose must be used on interchange cars. Reference to spliced hose eliminated.

Rule 60.—Sec. (L)—Modified to make mandatory, effective January 1, 1948, use of all A. A. R. standard limit gauges for checking wear of various parts of the AB valve to determine when any of the internal parts require repairs or renewal.

Rule 61.—Second paragraph modified to make mandatory the lubrication as well as inspection and testing, of geared hand brakes and to specify kind of lubricants.

Rule 63.—Sec. 6—The term "autogenous" used in Sec. (6) is changed to "fusion", to clarify the intent.

Rule 64.—Modified to permit substitution of unit nuts for common nuts without the use of lock nuts or nut locks.

Rule 65.—Modified to clarify intent missing journal wedges, as well as journal bearings is handling-line responsibility.

Rule 66.—Modified to clarify intent that if all boxes are repacked due to change of wheels or other work which necessitates removal of packing, charge for stencil is proper.

Rule 69.—Revised to prohibit the remounting of double-plate cast-iron wheels, and single-plate non-bracketed design cast-iron wheels, except the 650-lb. size. In this connection credit for such wheels removed and which require dismounting is specified in new Par. (c-5) of Rule 98.

Rule 70.—New Sec. (f)—Added to clarify intent, charge for new one-wear wrought-steel wheels applied, where permissible per Par. (d-2) or (e), in case of handling line responsibility must not exceed secondhand value, except when betterments are applied to car stenciled "New Standard".

Rule 82.—Additional remount limits for brake burn and comby conditions placed in rule to permit scrapping wheel against owner. Wheels having such defects are considered as unfit for reapplication and have, heretofore, been scrapped at handling-line expense.

Fig. 9—Explanatory text in Fig. 9 modified to show dimensions in terms of inches and fractions thereof rather than in terms of feet, inches and fractions thereof, to harmonize with similar modifications approved for Figure 119-A of the Wheel and Axle Manual.

Rule 95.—New paragraph added definitely to establish credit, on basis of secondhand or reclaimed value, for Type D coupler parts in connection with missing D coupler or when Type D is replaced with another type because of renewal of defective yoke.

Rule 98.—Par. (b1) and (b3)—Modified to permit charge for betterments applied to cars stenciled "New Std." where wheels are changed due to handling line responsibility.

Sec. (c)—Par. (4)—Modified to provide direct reference with respect to Rule 70 and to eliminate reference to double-plate wheels.

New Par. (c-5)—Added to provide method with respect to credit for secondhand double-plate wheels (cast on or after January 1, 1921) and single-plate non-bracketed cast-iron wheels removed account condemning defect on mate wheel or axle.

New Par. 7—Added, placing experimental cast-iron wheels of 1942 design and cast subsequent to 1941, in the same status at the A. A. R. standard single-plate bracketed wheels, as to charges, credits, substitutions, mounting, etc.

Note 4 following Sec. (g)—To clarify the following was added in the fifth line "Between the 'after turning' when applied and 'before turning' measurements when removed", covering the responsibility for difference in service metal on wrought-steel wheel when controversy arises between two different roads and the amount of service metal involved exceeds 2/16 in. per wheel.

Identification Table for Brake Beams—Reference to camber dimensions eliminated, conflicts with the camber of Std. A. A. R. Brake Beams as shown in Section E of the A. A. R. Manual and has no bearing on identification of A. A. R. brake beams and there are cases where brake beams under special cars conform to Std. A. A. R. beam in all other respects but have minimum camber in compression member due to clearances. Dimension from the face of brake head to hole in the strut is the proper dimension to check to determine A. A. R. brake beams, plus the dimension from brake head over back of the compression member therefore, reference to camber dimensions eliminated.

A. A. R. Approved Types of Geared Hand Brakes—Title modified to provide for identification markings stamped or cast on housing thereof, namely "AAR—1942". New last item added to table covering new horizontal vertical wheel type approved geared hand brake.

Rule 104.—Reference to radial design couplers, coupler bodies and butt castings eliminated because such Type D items are not being manufactured and such Type E items were never manufactured, hence such parts classed as Non-A. A. R. and credit reduced to scrap value, if owner does not authorize return of such material.

Rule 112.—Revised in Supplement 2 to provide more definitely for precedure in handling foreign freight cars destroyed or badly damaged in unfair usage. Dismantling cost increased because of increase in labor rates. Allowances for special items listed in Sec. 9(c) increased.

This rule is now divided into sections which set forth the privileges of both handling and car owner lines. In the first section handling line where it estimates damage is not to the extent of depreciated value of car may (1) make repairs at its own expense; (2) make necessary repairs and send car home on its own wheels with defect card attached bearing notation "Home for Repairs"; (3) send car home loaded on another car with defect cards attached, however, in this case handling line must assume cost of loading, pay $25 for unloading and assume transportation expense to home line.

If handling line desires to settle for car it must so advise car owner with statement as to major items of damage with a list of serviceable material that may be recovered under provisions of Section J, and if owner desires return of car such request will include authority to make temporary repairs at a cost not to exceed $50. In such cases handling line shall assume cost of loading and transportation over its line and car owner shall assume cost of unloading and transportation over its own or intermediate lines, however, if car is dismantled and not repaired owner shall pay handling line $50 for cost of loading plus cost of transportation over handling line. In no case shall cost of repairs exceed depreciated value less salvage. If however, cost of repairs is lower than this amount car owner may include in car repair bill the expenses incurred for temporary and partial repairs and transportation charges which will bring the total bill up to the depreciated value less salvage.

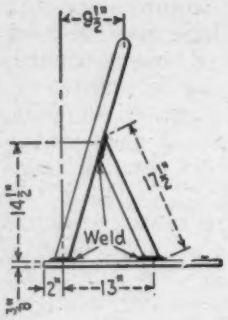
Rule 120.—Sec. (g)—Revised to more definitely set up method of determining salvage value of car.

Form covering authority for transfer or adjustment of lading shown on Page 273 has been revised to require additional information so that cars improperly loaded resulting in adjustment or transfer may be handled with the originating carriers for corrective measures.

Passenger Car Rules

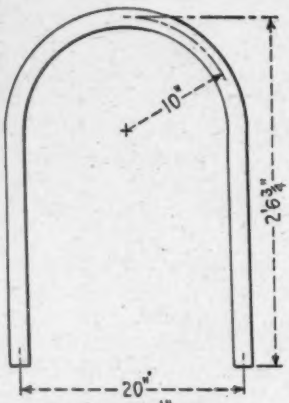
Rule 2.—Sec. (b)—Revised with respect to acceptance in interchange of passenger-cars equipped with installa-

(Continued on page 187)

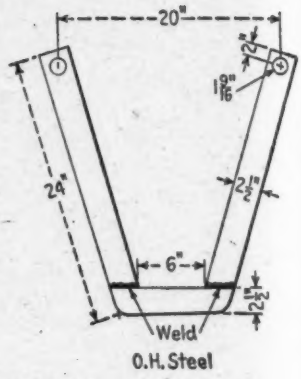


At the Glenwood wheel shop of the Baltimore & Ohio the new wheels are stored by size in rows outside the shop. The wheel rest, shown in the two top illustrations, is used to hold the stored wheels in a vertical position.

Wheel Shop Handling Devices



2nd Hand, 1½" O.D. Superheater Unit Tubing



O.H. Steel

When a wheel is needed in the shop it is picked up with the car-wheel hand truck, moved to the end of the roller conveyor shown at the left and below, and placed on the hinged end section in a vertical position. The wheel is raised to a horizontal position by the operation of the air cylinder, shown at the left, which is controlled by the three-way valve shown in the illustration at the bottom of the page. From here the wheel rolls by gravity down the conveyor and through openings in the shop wall to the boring mills. A description of the car-wheel hand truck appeared on page 21 of the January, 1946, issue. [Other handling devices used at this shop were described on pages 78 and 137 of the February and March, 1947, issues. More will be described in later issues.—Editor]

Interchange Rule Changes

(*Contiued from page 185*)

tions using inflammable liquids or gases having flash point of 80 deg. F. (open cup) or lower, which are used to operate engines or heaters for the purpose of lighting, heating, cooking, refrigeration or air conditioning. Such cars may at the option of receiving line, be rejected in interchange unless the fuel tanks have been removed. Receiving line may, however, accept such cars with or without fuel tanks in place if prior arrangements have been made to that effect, and providing the complete fuel installation complies with requirements specified in Sec. L of the A. A. R. Manual of Standard and Recommended Practice.

Rule 7.—New Par. 13—Added covering heat-treated multiple-wear wrought-steel wheels. Such wheels should be maintained in kind, however, substitution of non-heat-treated for heat-treated wheels or vice versa does not constitute improper repairs, but charges and credits shall be based on kind of wheels applied and removed.

Sec. g—Revised to provide dimensions for coupler heights for both passenger and non-passenger carrying cars, also instructions pertaining to adjustment of heights of buffers.

Rule 18.—New Third Note—Added which specifies that settlement for BX box express cars shall be on basis of this rule. Also new paragraph added covering return of serviceable material from passenger cars destroyed in unfair usage and basis of determining value thereof.

Maintenance of Air Brakes Still a Problem*

By T. H. Birch†

Air brake maintenance has been and apparently always will be a problem that is never adequately solved. Much effort and study have been given to the task but it is still a question if we are getting the proper results from the efforts expended. And now, more than ever, with the advent of new types of brake equipment, we must effect a big improvement in the standard of brake maintenance.

Inasmuch as air-brake maintenance is always a subject for discussion, a doubt is created as to whether we have used the proper approach in the past. Instruction pamphlets authorized by the A. A. R. tell us how the air brake and its parts should be maintained, and there is no doubt that if these instructions were followed literally it would be unnecessary to get together periodically and discuss this subject. However, it is not possible to have a task performed properly by the mere issuing of instruction pamphlets, otherwise many of us would not have a job. In other words, we cannot expect to run a railroad on paper.

Under the stress of war conditions it is possible that some air-brake practices of former times have been allowed to lapse and been replaced with others, and the first thing we should do is to determine which methods should be resumed and which abandoned, the dominant thought being to put brake equipment in such condition that trains may go over the road with a surplus margin of safety and a minimum number of failures.

* Abstract of a paper presented at the March 3 meeting of the Northwest Carmen's Association meeting at St. Paul, Minn.

† Air-brake foreman of the C. M. St. P. & P., Milwaukee, Wis.

Foremen Need to Know Brakes

We should not be content to allow air brake men to plod along day by day never being checked up on their work until the periodical visit of an air-brake instructor. The individual car foreman is generally inclined to depend entirely upon an air-brake instructor and experts employed by the air-brake manufacturers to see that the air-brake work in their respective districts is properly done, but it would be better for the car foreman to realize that these men are acting in an advisory capacity and that they can hardly be expected to handle routine matters such as the training of the employees. This is properly the function of the car foreman, who should be as conversant with the work of the air brake equipment (not the technicalities) as he is with the other lines of car maintenance. If he does not make himself competent to assume this duty, the service is bound to suffer.

I think it is generally agreed that a man could not be a car foreman unless, in addition to being able to repair a car, he is also conversant with the safety-appliance rules, loading rules, and many other items that are demanded by the A. A. R. Code of Rules. Therefore, would it be going too far to insist that the car foreman extend his general knowledge to take in air-brake maintenance? He should take advantage of the verbal and printed instructions that are given to him from time to time, for until he has mastered the fundamentals of the air brake he is not a full-fledged and qualified car foreman.

The methods of educating one's self along these lines must be left to one's own judgment and ingenuity to choose the one most adapted to him and his conditions, but I would suggest that the efficient way would be to take the various pamphlets issued by the A. A. R. and the individual railroad company pertaining to air-brake maintenance and devote a certain length of time each day to their study, and keep this up until you are able to impart the information to others. Avail yourself of every opportunity to ask questions regarding the workings of the air-brakes, especially when the air-brake instructor visits you, and I would suggest that you take time to do some of the work yourself. It is only in this way that you will become thoroughly acquainted with the work and enable you personally to ascertain whether the air brake is being adequately maintained at your respective points. And further, what a decided advantage it would give you over your men—an advantage which should be yours but is not unless you are able at all times to give your men the information they need to perform their duties properly.

Exacting Demands on Air-Brake Equipment

It is hard for even those who have been in constant touch with railroad developments to realize just how fast the tonnage handled by the railroads has been increased during the last few years and what efforts have been necessary on the part of the railroads and manufacturers to meet the requirements of safety promptly and economically. The increased tractive force of locomotives and the increased capacity of cars has resulted in a constant increase in length of train and tonnage handled per train, all of which has necessitated more care in handling and greater efficiency in the maintenance of air brakes. While it is true that manufacturers have made every effort to improve and change the equipment to meet the requirements, it is doubtful if they have kept pace; therefore, a higher standard of maintenance is required if we expect to get the desired results.

We hear much of operative brakes and I wonder

whether it is known what constitutes an operative brake. The general opinion is that it is one in which the piston moves out of the brake cylinder not more than 9 in. when a full service application is made from a 70-lb. brake pipe pressure and releases properly in the usual manner resorted to in making terminal tests, the only other requirement being that the foundation brake rigging be connected throughout to bring the brake shoes up to the wheels. This opinion is shared by practically all whose duty is air-brake inspection, but there is a good deal of difference between an operative brake and an efficient brake.

One Standard for Air-Brake Maintenance

To explain this intelligently, let us assume that a train of 20 cars starts from Terminal *A*, all brakes operative, and on arrival at Terminal *B* the train is increased to 60 cars, and on inspection it is found that some of the brakes in the original train of 20 cars will not apply under the more severe conditions on the rear of a 60-car train, and while they were considered an efficient brake in the 20-car train, they now have to be brought up to a better standard to be efficient in the 60-car train. On arrival at the last terminal before entering mountain territory, a retaining valve test is made and it is found that still others of the original 20 cars will not meet the test. All of this emphasizes that there should be only one standard of air-brake maintenance and that this requires doing the work as prescribed by the rules.

It would be superfluous to discuss each individual rule and method of procedure, as we are supposed to know this, and if we don't we should learn at the earliest possible moment. And, further, this does not mean that a high standard of maintenance should be in effect only at certain points on the line. It should be standard at all points where there are facilities for air-brake maintenance, for if only one or two points attempt to do 100 per cent work they will be immediately confronted with a prohibitive number of cars with inoperative brakes and a congestion which will cause serious delays and result in these particular points being criticized for tying up cars. If the stations on either side are fully on the job and this system is perpetuated all along the line, there will be no congestion and few inoperative brakes.

In this connection, each point where air-brake work is done should regard the station symbol that is part of the stencil placed upon the reservoir when the work is completed as a trademark, something to be proud of, something that would cause other points on the railroad when seeing this station symbol to remark that it means the air-brake work on this car has been done according to the rules prescribed.

Interdepartmental Cooperation Essential

Cooperation between the car, locomotive and operating departments is always essential. Let us consider only the traveling engineer. It goes without saying that in order to keep failures, delays and petty annoyances due to air-brake irregularities down to a minimum, the cooperation of the traveling engineer and the air-brake inspector is necessary. As changes in road conditions take place, the traveling engineer, because he is in close touch with the men handling trains and with operating instructions regarding tonnage and length of train, is in a position either to notice or have his attention called to irregularities which interfere with good train handling. And as a rule trainmen give their opinions freely as to cause and remedy for troubles to the traveling engineer. Although many of these opinions finally prove to be worthless, they are all worthy of consideration until the real cause of trouble is found. Close cooperation on the part of the traveling engineer and air-brake inspector is required in the analysis of suggestions offered by trainmen and of their own observations regarding the cause of and the past methods of overcoming difficulties. This results in intelligent conclusions and the application of the proper remedy.

The air-brake situation has become so involved and technical in the last few years that I would suggest creating a distinct classification of employees known as air-brake men. A regular apprentice course could be instituted whereby apprentices would devote the entire four years to learning air brakes, and have their own seniority rating. If this were done, we would eventually have nothing but experienced air-brake men on air-brake work. There should be no argument against a setup of this kind, because proper operation and maintenance of modern air-brakes requires a distinct study, entirely divorced from other car maintenance work such as sheet-metal, painting, pipe-fitting and other vital but no more important details.

The first of ten double-decked coaches ordered by the Long Island was received recently from the Altoona, Pa., shops of the Pennsylvania—Each car will seat 134 passengers, compared with an average of 72 in the road's standard coaches—The cars, built completely of aluminum, are about 81 feet long, and are ventilated by means of a ceiling duct through which cool air is circulated during hot weather and warm air in cold weather

Carbides on Railroad Jobs

Part I*

By Carroll Edgar†

A discussion of the various factors that influence the use of carbide tools on the jobs and machines usually found in the average shop

A FACT not generally appreciated is that the machining of locomotive wheels, piston rods, eccentric cranks, axles, etc., is a production job. In metal cutting, what you actually manufacture is "chips." It makes no difference whether those chips are removed from a few large or many small pieces. You still want to produce these chips in the shortest possible time with the least amount of effort on the part of the operator and at the lowest cost.

Carbide tools have the ability to: (1) remove more cubic inches of metal per minute than can other tools; (2) hold closer tolerances on the machined part while cutting at higher speed; (3) produce a better finish; (4) produce these results not only on new but also on "old" as well as large machine tools; (5) take interrupted cuts on either ferrous or non-ferrous metals and (6) mill both steel and iron at high speeds.

How to Use Carbides in Old Machines

It is true that most of the newer types of machine tools will do a better job with carbide tooling—as with any other tools—than can be done on older types of equipment. Nevertheless such tooling can be and is being used successfully on older machines. Today, moreover, it is important to increase the productivity of all machines.

The fundamental consideration when preparing older equipment for carbide tooling is that the machines must be able to run fast enough and *smoothly enough,* particularly when cutting steels. However, even when machining steels, "fast enough" may mean a speed of only 75 to 80 surface ft. per min. Actual speed required depends largely on hardness. Machine speed (in. r.p.m.) of course also depends on the size of the part, since the important thing is not revolutions per minute but surface feet per minute. The important factor is that linear cutting speed when machining steels should be high enough to prevent formation of a built-up edge on the carbide tip. The lower the carbon content of the steel, generally, the higher should be the speed. Further to check the suitability of a machine tool for use of carbide tools, the following general considerations are also important:

Power Requirements—It takes more power to run machines at higher speeds. More power is needed to cut steel than to cut cast iron or the non-ferrous metals. Check available machine horsepower against the required horsepower. The latter may be readily calculated from the formula:

*Part II will appear in a later issue.
†Development engineer, Carboloy Company, Inc., Detroit, Mich.

Carbide tools have not only made it possible to increase output but have assured better finish and freedom from frequent tool changing because of longer tool life between grinding

$Hp = D \times F \times S \times C +$ friction hp.

where D = Depth of cut, in.
F = Feed, in.
S = Cutting speed, surface ft. per min.
C = Power constant

This power constant C varies from 6 to 10, depending on the steel to be cut:

Steel	*Constant*
1010-1025	6
1030-1095	8
1112-1120	6
X1314-X1340	8
T1330-1350	9
2015-2320	7
2330-2350	9
3115-3130	8
3135-3450	9
4130-4820	9
5120-5200	10
6115-6195	10
Cast steel	9

The friction horsepower—the power needed to operate the machine idle at the specified speed—is usually figured at 30 per cent of the horsepower required for cutting.

Power Transmission—All belts, clutches, etc., should next be checked for their ability to transmit the required horsepower to the spindle. Clutch fingers should be adjusted to prevent slipping and stalling. If the machine is equipped with a flat belt, it will usually be found desirable to change to a vee-belt drive, making sure that the number of belts is adequate for the horsepower transmitted. (Incidentally, if the machine should stall in the cut while tooled with carbides, loosen the holding screws —the rear one first—and remove the tool from the cut to prevent breakage. Do not try to move the work or back the tool out of the cut).

Centers—The increased speed makes it advisable though not essential to use anti-friction tail-stock centers.

One of the most important railroad shop jobs is that of boring wheels—On this battery of machines carbide tools have made possible an eight-hour output of between 135 and 140 wheels

Spindles—Spindles should be checked for adequate lubrication at the higher speeds at which they will operate.

Tool Posts and Holders—A flat-bottomed tool post that brings the tool up to the centerline of the work piece *with shims* works best with carbide tools. An assortment of shims or varying thicknesses should be kept on hand. If a rocker type tool post must be used, take out the rocker base and turn the tool post collar upside down. The tool can then be held rigidly in a horizontal position and shimmed up to the centerline of the work.

Chip Room—To handle the increased volume of chip production, sheet-metal chutes frequently prove helpful to prevent chips from clogging. Use of chip breakers on cutting tools helps to maintain chip control when cutting long chip metals such as steel.

Bachlash—Machines should be checked for any excessive clearances that might cause chatter at the higher cutting speeds. Worn bearings should be replaced. Slides and ways should be tightened. A small amount of chatter, however, can be eliminated merely by using negative rakes on the tools.

If the foregoing suggestions are carried out there is no reason why even quite old machines cannot be used effectively with carbide tools. What it boils down to is that if the machine can handle the horsepower required at the higher speed, and can be tightened up enough to eliminate backlash and chatter, its productivity can be greatly increased simply through the use of carbide tooling.

Using Carbides on Large Machines and Heavy Work Pieces

Many jobs encountered in the average machine shop weigh hundreds and even thousands of pounds. These require large machines. Experience shows that use of carbides on such machines provides the same advantages as on smaller machines. These include increased cutting speed; ability to reduce feed for better finish without sacrifice in output of chips per hour; ability to machine the hardest commercial metal with ease; materially increased tool life between grinds; fewer shutdowns; less tool re-setting, etc.

For instance a good example, while not a railroad shop job, is that of machining a 183,000-lb. forged .40 carbon-steel generator shaft having diameters running up to 7 ft. In this case tool economy is a problem of *inches cut per grind* rather than of *pieces per grind*. High-speed steel tools showed a few thousandths of an inch wear every four or five inches of longitudinal travel—that is, every 130 to 160 revolutions. Since the generator end of the shaft alone is over 21 feet long, frequent re-setting and grinding of the high-speed-steel tools was involved. With carbide tools on this job, however, the entire length is now cut with a single grind and only one simple hand stoning of the tools in the machine. The three single-point Carboloy tools used—one straight turning tool, one left-hand offset, and one right-hand offset—reduced machining time to 95 hours by permitting a step-up in speed from the original 30 surface ft. per min. to 90 ft. per min.

Another illustration of the ability of carbides to handle large jobs more efficiently than conventional types of tools is a steel casting for a rotor spider hub. Prior to tooling up with carbides on this job, the high-speed steel tools broke or became dulled after only three or four revolutions, due to the presence of sand and blow holes in the casting. With two single-point Carboloy turning tools, the entire length of the riser was cut before re-grinding became necessary. This is a distance of 37 inches. Depth

of cut was ¾-in. with a 1/16-in. feed per revolution. Chip removal in this case totalled 612 lb. per hour. Due to the angle of the tool, chips were about 1-in. wide.

Inasmuch as quite a bit of planning of heavy parts is done in locomotive machine shops—as for instance on engine-truck frames, trailer-truck boxes, radius bars, trailer-truck side bearings, etc.—it is of interest to note that experience in other fields has demonstrated that with good tool practice and good operators, carbide tools give excellent results both on the new planing machines (capable of 200 surface ft. per min.) and on the older types of planers with top practical speeds as low as 70 surface f.p.m. or even lower. In such jobs as the rough machining of a cast base on a 20-ft. planer at 200 surface f.p.m.—the carbide tools take heavy impact loads successfully. On the new planers it is reported that carbides not only permit greater output per machine, but also give better size and finish than can be obtained with high-speed steel tools. When used on the slower and older planing machines, carbides have the advantage of materially longer service life between grinds.

With regard to large parts of extreme hardness, the experience of a producer of railroad turntable wheels may be of interest. These wheels are manganese-steel castings with a Brinell hardness of 550 or more. Until the introduction of carbide cutting tools, these wheels had to be finished by grinding—a slow process.

These wheels range from 14 in. to 20 in. in diameter. They are now faced on both sides and then bored on a vertical boring mill with carbide tools. After the wheel is pressed onto the axle shaft, the assembly is mounted in a large engine lathe with one end of the shaft chucked and the other supported in the tailstock, for rough and finish turning. In turning the wheel, a 1/16-in. depth of cut and .020-in. feed is used to remove the pitted surface material and take care of casting run-out. A deeper cut is then taken. Cutting speed in this instance is relatively low—around 45 surface f.p.m.—to reduce chances of shock breakage due to hard manganese spots and surface pitting of the casting.

The ability of carbide to cut alloy steels ordinarily considered difficult to machine is well illustrated by one application made in the machine shop of a midwest railroad. Here, turning with carbides is combined with metal spraying to produce such reconditioned locomotive parts as shafts, water pump piston rods, motor armature shafts, shafts, water pump piston rods, armature shafts, etc.

In practice, 18-8 stainless wire is sprayed with an oxy-acetylene flame in such a way that even deposition on the work part is obtained. Spraying is to a depth of from 1/64 in. to 1/32 in. per side *in excess of the size* to which the part is to be finish machined. To obtain the fine degree of finish desired, the sprayed metal finishes are turned at high speeds—from 200 to 450 surface f.p.m. —with fine cuts and a slow feed. Performance of the carbide tools on this assignment can be appreciated from the fact that on a typical part—an air and water pump rod 2 ft. long by 1¾ in. in diameter—floor-to-floor time is 20 minutes with approximately 12 pieces being machined per grind of the carbide tool.

Among the factors which have contributed to the ability of carbides to be used successfully on large machines and heavy work are our vastly increased knowledge of proper feeds and speeds; better design of clamping fixtures; use of rigid tool holders; simple methods of determining shank and tip sizes required for handling heavy cuts; and an increased knowledge of proper tool shape and cutting angles for specific applications.

In connection with this latter point, the development of negative back rake angle tools has contributed greatly to the ability of carbides to handle heavy cuts.

Proper Tool Mounting for Heavy Jobs

When setting up a job on a carbide tooled machine the tool should be set to cut on the centerline of the work-piece or up to 1/64 in. ahead. It should never cut behind the centerline. Carbide tools need a rigid support. Tool overhang should be kept at a minimum to prevent chatter and possible breakage of the cutting tip. No more overhang should be allowed than is necessary for work clearance and chip room.

Use dog point or flat clamping screws. Avoid hitting the carbide tip when loading or unloading work. When setting tools, be sure to strike or pound the tools *below* the carbide tip. Use a plug to avoid hitting the tip.

The use of quick-demountable tool holders cuts machine down time. With such holders tools can be ground and adjusted to cutting depth in the tool room. Then, when it is necessary to change tools, one tool holder is simply removed and a new one slipped into place. At most, only a slight touch-up adjustment is needed—usually not even that—and the machine is running again. When several tools are used on one machine, the saving in time really mounts up.

Using Negative Rakes for Turning

The idea of using negative rakes on carbide turning tools is not new. In fact, during the past few years it has thoroughly proved its worth. During the war, for instance, virtually all shell manufacturers employ negative rake turning for roughing cuts. Frequently, negative rake turning of steel has been found to materially ting edge against chipping. This is especially true where work is eccentric; on interrupted cuts; and where an appreciable amount of scale is present, as on forgings.

Use of negative back rake protects the cutting edge of a carbide tool because any irregularities on the surface of the work piece—scale, lugs, etc.—will strike the tool *in back* of rather than *on* the nose, which is the weakest part of a carbide tool. A negative *side* rake tends to throw the chip back away from the cutting edge, thereby warding off the chipping of the carbide blank in a longitudinal direction. Carbide tools that are ground with negative rakes have been found to chip less easily than positive rake tools, especially when machining large, eccentric forgings that are heavily crusted with scale.

Locomotive Boiler Questions and Answers

By George M. Davies

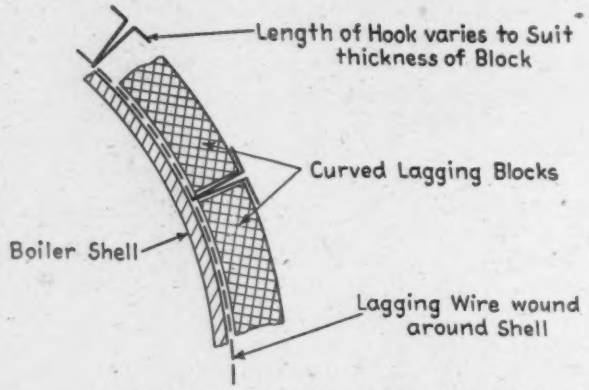
(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Boiler Lagging

Q.—When lagging a locomotive boiler is the lagging cemented to the boiler? What materials are used in lagging the boiler? —F. E. W.

A.—Locomotive boiler service requires an insulating material that has high thermal efficiency, light weight, good mechanical strength and the ability to withstand

vibration, impact and shock. In addition, the ideal material should be easy to work, handle and apply, and because of boiler testing and inspection requirements, the



The use of the hook and wire in applying lagging to the boiler shell

insulation should be such as to permit ready removal and reapplication with a minimum waste, trouble and expense. The insulation that best fulfills these requirements is 85 per cent Magnesia.

For lagging the shell of the boiler, the lagging is furnished in blocks, 6 in. by 38 in. with thicknesses from 1 in. to 3 in., and with the thickness tapering wth the length. The blocks are furnished flat or curved to suit the contour of the shell and are held in place by means of cables and special wire attachment hooks. The lagging wires or cables around the shell are spaced about 24 in. apart for 36-in. blocks. This method of attachment not only facilitates the attachment of the lagging blocks, but also permits the removal of one or more blocks, where necessary, without disturbing the adjacent sections.

Circumferential spaces between the lagging blocks are filled with 85 per cent magnesia cement. Where the firebox is supported with flexible staybolts, this area is lagged by filling in the spaces between the staybolt heads with strips cut from block lagging and then covered with a finish coat of 85 per cent Magnesia cement to obtain a smooth surface and proper contour.

Questions and Answers On Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

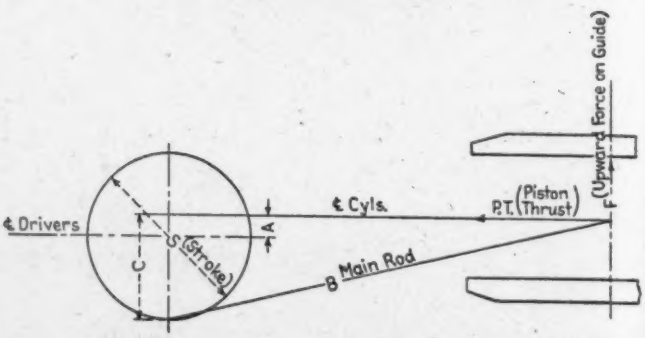
Bearing Pressure on Crosshead Lining

Q.—The linings of the crossheads on some of our locomotives do not give very satisfactory service, and the question has been raised as to the possibility of an excessive load on the shoes being the cause of the trouble. The engines are equipped with an alligator type crosshead, and the crosshead shoes are lined in the usual manner.—F. J. M.

A.—The practice is to keep the maximum bearing pressure on the crosshead shoes below 100 lb. per sq. in. This is computed by the following formulas:

$$F = \frac{PT \times C}{B} \text{ and } BP = \frac{F}{1 \times W}, \text{ in which:}$$

PT = Piston Thrust in pounds = Boiler Pressure multiplied by the piston area.
A = Vertical distance in inches between the center line of the drivers and the center line of the cylinders.
B = Length of the main rod in inches.
S = Stroke in inches.
$C = \frac{1}{2} S + A$ (where cylinder centers are above center line of drivers).
$C = \frac{1}{2} S - A$ (where cylinder centers are below center line of drivers).
F = Upward force on the guide in pounds.
BP = Bearing pressure on the crosshead shoe in lb. per sq. in.
L = Length of the crosshead shoe in inches.
W = Width of the crosshead shoe in inches.



Dimensions used in computing the bearing pressure on crosshead lining and shoes

Assuming a locomotive having 23½-in. by 26-in. cylinders with 200 lb. boiler pressure, 114-in. main rod, the center line of the cylinders 2 in. above the center line of the drivers, and the crosshead shoes 6 in. by 24 in., substituting in the formulas we have:

$$PT = 3.1416 \times (11.75)^2 \times 200 = 86{,}750 \text{ lb.}$$

$$F = \frac{86750 \times (13 + 2)}{114} = 11{,}414 \text{ lb.}$$

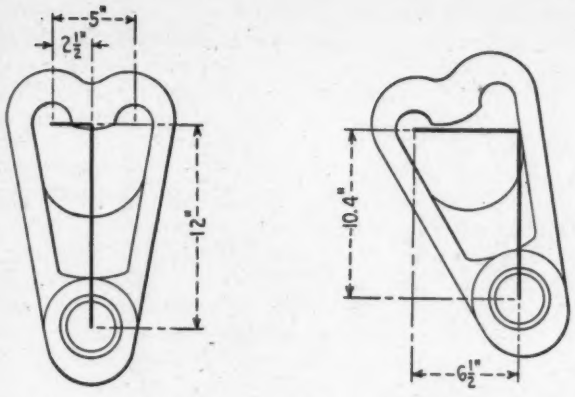
$$BP = \frac{11414}{6 \times 24} = 79.2 \text{ lb.}$$

In this case the bearing pressure is well within the maximum of 100 lb. per sq. in. With properly lubricated guides and with the crossheads tinned with good-quality babbitt satisfactory service should be obtained.

Engine Truck Centering Devices

Q.—What is the action of an engine truck equipped with a rocker-type centering device as compared to one equipped with the hanger-type centering device? What is meant by the term constant-resistant engine truck? Is the centering action more positive on a truck equipped with the hanger-type centering device?—E. A. C.

A.—The centering device of an engine truck, whether a rocker or hanger type, is used to control the side movement of the truck and to provide a means for bringing the truck back to its central position after passing through a curve and to keep it in that position until it is again diverted by a change in the direction of the track. The truck should help the driving wheels negotiate the curve and exert sufficient side thrust against the engine frame,



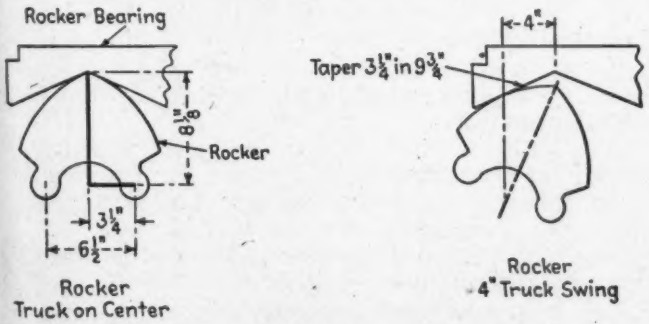
Action of a 5-in. by 12-in. swing hanger in controlling the side movement of the engine truck

through the truck bolster and engine center casting, to pull the front driving wheel away from the outer rail or at least relieve the severity of the force with which it presses against it. The difference between the two types of centering devices is the effectiveness of exerting this side force.

With a typical 5-in. by 12-in. swing hanger, the initial resistance, or lateral thrust, which keeps the truck in central position would be:

$2.5 \div 12 = .208$, or 20.8 per cent of the weight on the truck.

The resistance, or lateral thrust, exerted by this truck with a 4-in. side movement of the truck would be:



Leverage of the rocker-type centering device

$6.5 \div 10.4 = .625$, or 62.5 per cent of the weight on the truck.

The engine-truck rocker illustrated is typical and was used in a truck that was designed to replace one equipped with 5-in. by 12-in. hangers. The initial resistance, or lateral thrust, which keeps this truck in central position would be:

$3.25 \div 8.125 = .40$, or 40 per cent of the weight on the truck.

When this rocker has been moved from its central position it acts as a roller on the top rocker bearing and the resistance or lateral thrust stays uniform with the slope of the rocker bearing, the resistance being:

$3.25 \div 9.75 = .333$, or 33⅓ per cent of the weight on the truck.

Based on the above, the action of an engine truck equipped with a rocker-type centering device as compared to one equipped with the hanger-type centering device would be in the resistance, or lateral thrust comparison:

	Swing hanger	Rocker type
Initial resistance	20.8 per cent	40 per cent
Resistance with 4-in. truck swing	62.5 per cent	33⅓ per cent

The term constant-resistant truck is applicable only to the rocker-type centering device, in that with this type of centering device, once the truck moves off center, the resistance or lateral thrust of the truck stays constant irrespective of the amount of side movement of the truck. The rocker-type centering device is more positive in keeping the truck central on a straight track due to its high initial resistance; thus the tendency of the engine to sway from side to side at high speeds is considerably reduced. The swing-hanger-type truck is more positive in returning the truck to its central position in that it builds up a considerably higher resistance or lateral thrust as the side movement of the truck increases. Of the two types, the rocker-type centering device should give a smoother-acting engine truck.

Engine Failures

[In preceding issues appeared an abstract and discussions of the paper entitled, "Engine Failures," presented by James Grant, superintendent of motive, Atlantic Coast Line, Waycross, Ga., before a meeting of the Southern & Southwestern Railway Club at the Ansley Hotel, Atlanta, Ga., on September 19, 1946. In this issue appear several of the oral discussions of the subject, in question and answer form, by members present at the meeting. In each instance the name of the member answering the questions is given.—Editor]

A. C. Schroeder, Seaboard Air Line, answered the following questions on Diesel-locomotive maintenance:

Q.—How have you managed to eliminate oil failures?

A.—We have maintained a pretty good record by cleaning and washing all radiators and coolers. We have some breakage and turning of main bearings. If we could all get together and get back our old steel-backed bearings and watch our pressure pumps I think we will eliminate practically all our troubles.

Q.—At what mileage do you send samples of lubricating oil to be tested?

A.—We haven't tested any oil unless we have a failure. We change every 30,000 miles in passenger service and every 12,000 in freight.

Q.—Are most failures attributed to water or oil?

A.—Most are caused by bearings, straps, etc.

Q.—Do you use reclaimed lubricating oil?

A.—We use make-up only.

The following questions were answered by W. D. Shults, general foreman, Southern, Atlanta, Ga.

Q.—We clean our valves; where you have sectional packing I believe you dismantle valves and clean them, don't you?

A.—No; we did, but found it is not necessary. Most of the men in the enginehouse keep a record between inspections of definite jobs they have had trouble with and at quarterly inspection they know they have to do these certain things and get ready for them. We found that pulling of valves every 90 days was not necessary. I believe it best not to disturb them unless you have to. Where you find excessive carbon do you go into the quality of the lubrication? Don't you find it is due to feeding too much oil and improper handling of the engine?

Answer by questioner—Yes sir, that is the best answer you can give. What did you do on the Southern to overcome this carbon trouble?

A.—We blanked the reverse lever quadrant off so that the engineman couldn't work his lever too far back with a wide open throttle.

Q.—How many notches do you cut off?

A.—Fifteen to twenty per cent cut off. We had a

Federal inspector ride with us on a bunch of bad riding locomotives and found that most of our trouble was caused by working the locomotive at too short a cut-off and that brought about the arrangement whereby we put this gadget on the quadrant where you can't work the lever back too far. Most of our old enginemen didn't like this and they would get out on the road and take a wrench and yank it off so we had to go ahead and weld the nuts, but after they use it a while they like it better—gives considerably better performance. On our district we had a number of bent rails and we recounterbalanced every engine we had and would bend no rails for a month or two and then all at once we would have an epidemic. We put these gadgets on and haven't bent a rail since and that was two years ago.

The following questions were answered by A. T. Miller, assistant superintendent motive power, Atlanta & West Point:

Q.—Do you use a quartering machine and has it increased the life of your bushings?

A.—Yes, we use quartering machines and we know we get more mileage from our bushings.

Q.—What is the average mileage from shopping to shopping?

A.—It averages about 60,000 miles.

Q.—At what mileage do you renew main axles?

A.—We renew main axles at 500,000 miles and main pins at 300,000 miles.

Q.—Do you expect to keep on with this practice of renewing them every 500,000 miles?

A.—Yes, those are our instructions. It is a fact that our experience has shown that our failures have been on axles and crank pins that have made low mileage and the inference to be drawn from that is that if there is an incipient defect it will probably show up in the first 100,000 miles, and if it doesn't show up then, it is a good piece of material.

Q.—The Magnaflux machine has grought a lot of new things into our shop practices, but occasionally we will have a rod fail a very short time after it was Magnafluxed and we wonder how often it would pay to Magnaflux side rods or piston rods?

A.—Now I am probably going to stick my neck out too far. Our experience with the Magnaflux process has been about the same as other roads' experience. We Magnaflux our rods every three months but I don't think that that will eliminate rod failures. My theory is that a progressive fracture once started in a part like a rod can progress to the point of failure in the course of one trip. I believe that at diameter speed the reciprocating parts reverse their direction about eleven times per second, so we can see that a part like a rod sustains an enormous number of blows in the course of a trip over the average division. I believe that a nick or other starting point for a progressive fracture can be so small at the beginning of the trip that it cannot be seen and yet fail before reaching destination terminal.

Q.—You just made a statement that in your opinion a rod could develop a crack after leaving a terminal and become an engine failure before reaching the end of its trip.

A.—Yes, and here is one item in support of it. We have some pretty good inspectors and even before we had Magnaflux they would from time to time discover cracks in rods so minute that they would have to chalk mark the location and hand you a magnifying glass before you could see the crack. But they never found a rod with a fracture half way through, or a quarter through or ten per cent through. Why? Because if there is a crack there at all it will progress to the point of failure in the one trip. Has anyone here ever seen a rod that had a crack in it that was found in the enginehouse on inspection and the crack when found had already progressed say ten per cent of the cross section?

The following questions were answered by W. D. Shults:

Q.—Is it the practice on the Southern to press driving wheels off or partly off of axles for magnafluxing and inspection?

A.—Before we put in our quartering and journal truing machines we would press the main wheel off about one and one-quarter inches and turn the journal and roll the fillet but since putting in the quartering and journal truing machines this practice has been stopped. We have one type of engine that in the past broke a good many main axles. We have recently redesigned and put in heavier main axles for this type of engine which has practically eliminated breakage.

Q.—Did you press these main wheels off and magnaflux the main axles?

A.—We did on some few occasions but it was not the general practice nor did I believe that it was good practice to disturb the fit on main axles by pressing the wheel partly off to make repairs. It is my opinion that if each time the engine gets general repairs the wheels are run through the quartering and journal truing machines and the main journals and main pins turned these pins and axles should run until they are turned down to the condemning limit with the exception that if there has been a hot pin or hot journal then the first time the engine is in the shop for heavy repairs this pin or axle should be removed.

Answers by W. A. Jones, general foreman, Seaboard, Hamlet, N. C.:

Q.—How long does it take you to get a quarterly?

A.—Sometimes in eight hours but then others sometimes take a week.

Q.—Do you think a side rod or main rod can break from terminal to terminal?

A.—Well, if it is going to leave here good and break before it gets to the end of the trip—well, I just don't see how it can do that.

Q.—Can a rod break between here and Jacksonville, running on a passenger train, if it was not defective on leaving here?

A.—Yes, it can break anywhere.

Q.—Do you remove your journal bearings on the engine truck at quarterly inspection?

A.—On regular road inspection engines we remove them every six months.

H. C. Taylor, Diesel superintendent, Southern, answered the following questions concerning Diesel-electric locomotive maintenance:

Q.—What about crankshaft failures?

A.—Trouble experienced on the Southern with respect to crankshaft failures has been largely due to bearings turning in the frame caused by water leaking into the lubricating oil and also by overheating of the lubricating oil. High temperature is caused from restricted oil coolers. To overcome this condition we are installing high temperature switches to the oil circuit which will, in case of over-temperature, reduce the engine to idle.

Q.—To what do you attribute the majority of bearing and crankshaft failures on your railroad?

A.—We recently had a failure where only one main bearing was involved. An examination revealed all bearings were of the "A" Type which had a .005-in. larger diameter bore, except at the location where the failure occurred. A standard bearing had been applied, which in our opinion was the cause of failure due to heavy load concentration.

Q.—Are you replacing all main bearings at the same time?

A.—So far we haven't been; however, I believe it will

be advisable to do so in order to keep the load equally distributed on all main bearings.

Q.—I would like to know if it is definitely decided by more than one party what causes failure of bearings?

A.—No standard practice has been put in effect as to just how many will be present when decision is made as to cause of failure. This is usually decided by the Diesel foreman in charge and the general Diesel supervisor after the engine has been dismantled and a thorough inspection made of the failed parts.

Q.—What percentage do you allow main bearings to go over 100,000 miles before inspection is made?

A.—We make every effort to remove all main bearings at 100,000 miles or less.

Q.—Do you think it would be safe to run them 125,000 miles? It is very difficult to get them all on 100,000 miles without going over; don't you think 125,000 miles would be safe?

A.—I am of the opinion that bearings should be inspected at 100,000 miles rather than let them run 25 per cent over.

Q.—How many Diesels are you maintaining per day at your Alexandria shop?

A.—We are maintaining a total of sixteen 1,350-hp. freight units at our Alexandria, Virginia, shop. Two mechanics are used for removing and inspecting main bearings.

Q.—What mileage do you remove traction motors for overhauling?

A.—We remove all traction motors for basic overhaul after 200,000 miles of service. At the present time we have very few motors on the Southern operating beyond this mileage. I would like to know if any of you are experiencing trouble on your railroad due to grounded traction-motor armatures. From our experience in the past we are definitely of the opinion that motors should be removed for basic overhauling at 200,000 miles.

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

507—Q.—What does the rotary valve seat portion consist of? A.—The rotary valve seat *225* and the selector cock *203*.

508—Q.—Where is it located? A.—The rotary valve seat is located between the brake valve body and the application portion.

509—Q.—Where is the selector cock located? A.—The selector cock is attached to the rotary valve seat.

510—Q.—What is the duty of the selector cock? A.—Selector cock *203* is used to change over from controlled full release to main reservoir full release, or the reverse when desired. The cock is manually operated to point to *MR* on top of the cock body when main reservoir full release is used and to *FV* when controlled full release is used.

511—Q.—How does the service application portion function? A.—The service application portion *110* (Fig. 8), functions to provide a service brake application when initiated from the safety control or train control application.

512—Q.—Does this portion have any effect otherwise on the braking as controlled from the automatic or independent brake valves? A.—Otherwise piston *112*, (Section *C-C*) is held in realease position by spring *129* (main reservoir air pressure balanced on both sides of piston *112*) and this portion has no effect on the braking as controlled from the automatic or independent brake valves.

513—Q.—What happens when the air pressure on top of piston 112 is reduced from a safety control or train control application? A.—When the air pressure on top of piston *112* is reduced, the air pressure under the piston moves the piston and slide valve *114* to application position.

514—Q.—Is feed valve air connected to the brake pipe in application position? A.—No.

515—Q.—Explain how this is done. A.—(a) The cut-off valve chamber around spring *155*, (Section *C-C*), is connected to the slide valve exhaust, which permits the higher pressure on the other side of cut-off piston *146* to move the cut-off valve *151* to closed position and cut off the flow of feed valve supply air to the brake pipe.

516—Q.—What caused the equalising piston to move to application position during a Safety or Train Control application? A.—(b) The passage from the equalizing reservoir and the top of the equalizing piston *77*, (Section *D-D*), is connected to two passages; one passage which leads to the reduction limiting reservoir and the other to the second reduction reservoir. This permits the brake pipe air under piston *77* to move the piston to Application position.

Rolling Superheater Flues

An unusual and efficient method of rolling superheater flues has recently been developed by the Rook shop of the Pittsburgh & West Virginia. A No. 4086 Duff-Norton Motor Attachment, originally designed to convert hand-operated jacks to air-power raise, is attached to a standard 5½-in. superheater-flue roller with a No. 3 shank and is operated by a small reversible air motor as shown in the accompanying illustration. The worm gearing in the motor attachment multiplies the motor torque 22 times.

This method avoids the complicated framework which formerly had to be bolted across the engine structure and which took more than an hour to set up and take down. When only a few flues must be repaired, the motor attachment arrangement is particularly efficient as the assembly and disassembly times of the framework amounted to a noticeable portion of the total job time.

Rolling 5½-in. superheater flues with a flue roller operated by an air motor and attachment

ELECTRICAL SECTION

Air-Started Engine For

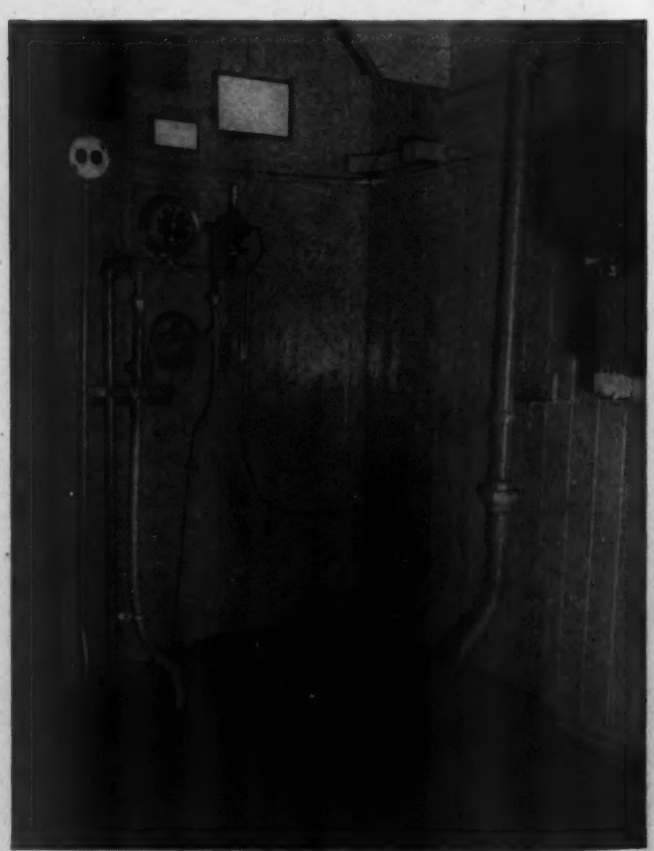
Caboose Power Supply

The engine and generator in the housing under the caboose—A removable side cover facilitates inspection and maintenance—The bottom of the housing is constructed so it can be dropped with the Diesel engine to facilitate removing the engine for heavy repairs or to replace the engine

THE Chicago, Rock Island and Pacific now has in operation a caboose power unit which is designed to supply communication power requirements and 200 watts of lighting load. The unit operates on Diesel fuel oil and is independent of the need for batteries on the caboose. It consists of a single-cylinder Lister-Blackstone engine running at less than rated speed, driving a 1,500-volt-ampere, 115-volt, single-phase a. c. generator. The engine is started by means of an air starter from the air train line.

Air for starting is secured from the train line through two air chokes, two check valves and an air reservoir. The air reservoir pressure is kept at an average of 3 pounds below the air train line pressure. This supplies enough air to start the engine without drawing air from the train line at a rate which would set the air brakes of the train. A rotary air motor is used for starting. It employs a Bendix gear similar to those used on automobiles, which disengages automatically as soon as the speed of the engine flywheel is greater than the speed of the air motor.

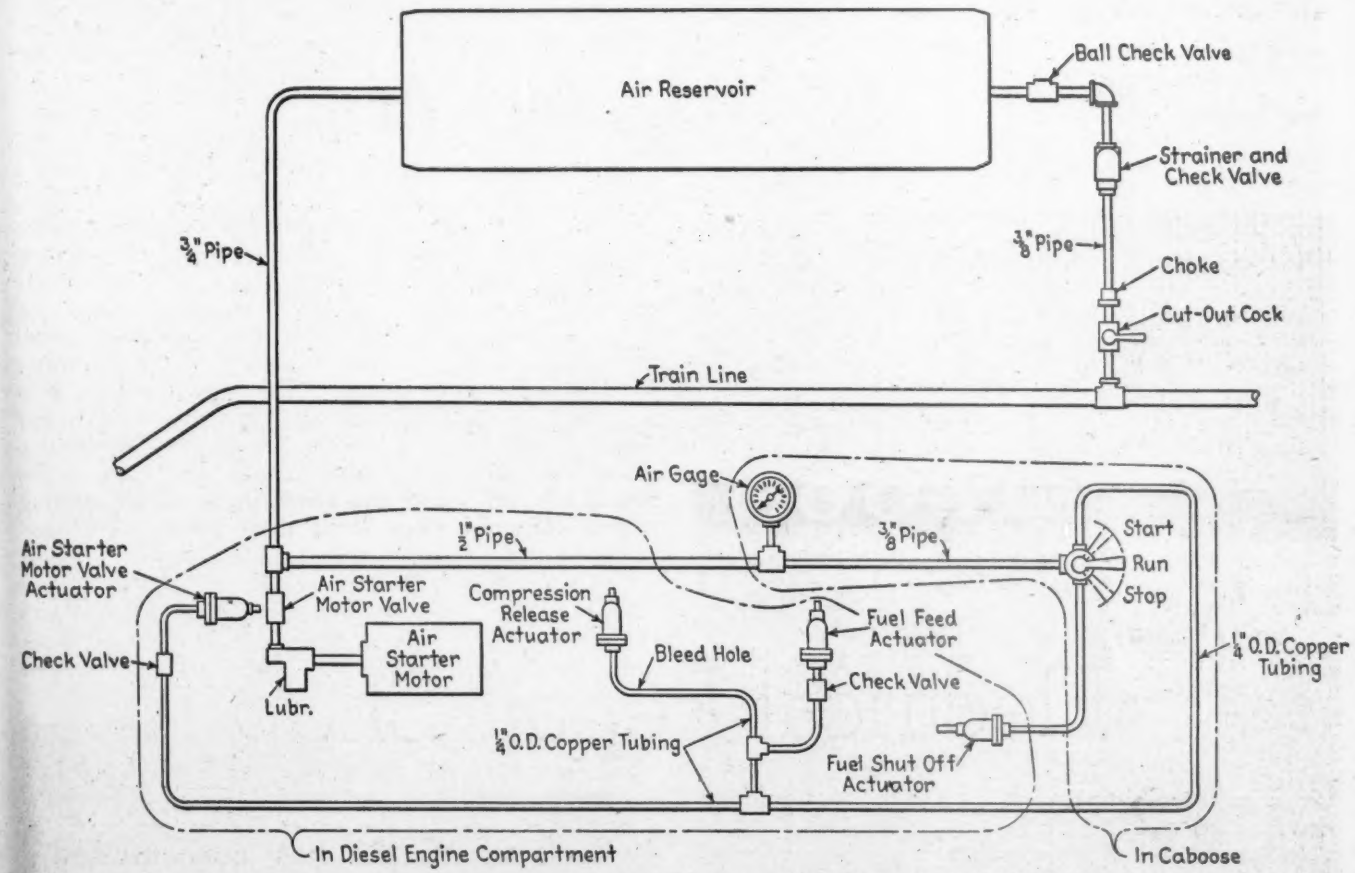
A three-way valve is used to control the air for starting and stopping the engine. For starting, the valve is placed in the "start" position for about 5 seconds and then back to the running position. This procedure causes the air to release the cylinder compression, turn on the fuel at the fuel pump and admit air to the air starting motor. The manner in which these actuators are connected is shown in the diagram. The air-starting motor is thus caused to crank the engine for a period of 5 seconds without compression, and for 15 seconds with compression. At the end of the 20 seconds the check valve, which operates the air-started motor valve, has



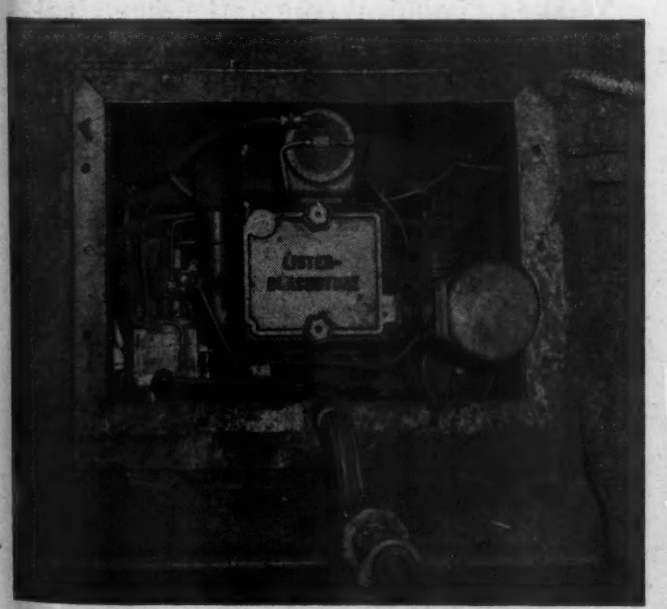
Interior of the caboose showing the controls, the cover over the engine and the unit heater at the right

allowed enough air to escape from the air cylinder that actuates the air-motor-starter valve to allow the spring in the air cylinder to return the piston to the normal position, thus shutting off the air to the air-starting motor. The bleed hole shown in the diagram bleeds the air cylinder that operates the compression instantly when the three-way valve is returned to the "run" position. The check valve in the line to the fuel feed actuator keeps the fuel turned on for 15 seconds after the starting valve is returned to the "run" position. After the engine has started, the lubricating oil pressure keeps the fuel valve open.

If the engine has not started during the 20-second starting period, it is necessary to repeat the operation. The three-way valve is also used to stop the engine. When moved to the "stop" position, air is caused to operate the fuel shut-off actuator, which closes the fuel line at the fuel pump.



Schematic piping diagram for the engine starter



Top view of the engine with cover removed showing its location under the floor

The engine is rated 8 hp. at 1,200 r. p. m., but is set to operate at 700 r. p. m. It is installed under the floor of the caboose and can also be started with a hand crank from the ground. The a. c. generator, which is rated 1,500-volt-amperes at 115 volts is driven from the engine by a V-belt drive at 1,800 r. p. m.

Engine cooling is accomplished by a unit heater having a 1/8-hp., 115-volt, a. c. single-phase motor to drive the fan. This heater was used primarily to eliminate the Diesel engine radiator and thereby simplify the installation underneath the car. It can also be used to heat the car.

There are no batteries used in this installation, but the generator is equipped with a d. c. 12-volt winding, which may be used for battery starting, either alone or in conjunction with the air-starting motor. The d. c. winding on the generator will also keep the battery charged.

The constant load on the generator consists of the radio equipment and the unit-heater fan motor. This equipment draws approximately 700-volt-amperes. Full lighting load is 200 watts, making a maximum load of 900-volt-amperes on the 1,500-volt-ampere machine. Outlets for electric marker lights are provided on each end of the caboose.

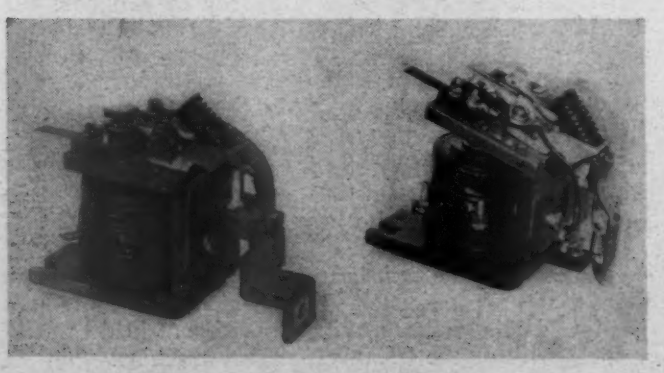
General view of the shop showing the baking oven at the left and the doors to the cleaning and battery rooms at the back

Electrical Repair Shop

Missouri Pacific has concentrated most of its general electrical repair work at Sedalia, Mo., and new shop makes repairs on all electrical equipment except Diesel locomotives

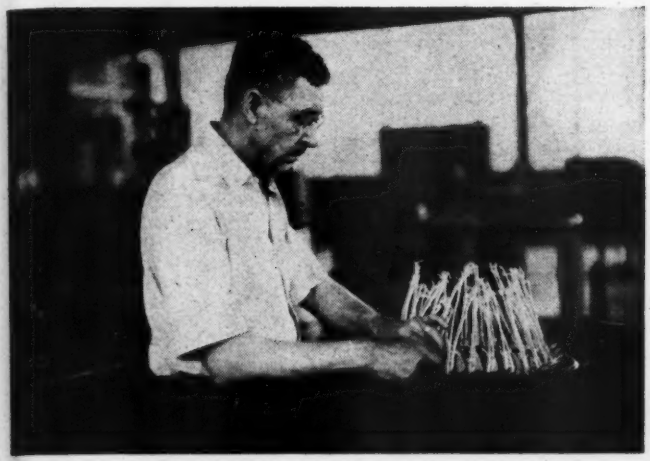
THE Missouri Pacific electrical repair shop at Sedalia, Mo., affords a particularly good example of railroad electrical maintenance requirements since it is designed for the performance of all heavy repair work other than Diesel-electric locomotives, and the shop has been recently equipped to meet present-day requirements. Many other shops perform only a part of these functions, and in other cases, both general and Diesel-electric work are done together and it is difficult to segregate the requirements of either one or the other.

The work done in the Sedalia shop includes running repair and overhaul work on all passenger coaches going through the Sedalia coach shop and all major electrical repair work, including cars, steam locomotives and shop and wayside equipment, for about two-thirds of the railroad. The road operates 794 steam locomotives, 58 Diesel-electric locomotives, and 537 passenger cars including 12 motor cars, over 7,082 miles of line. The shop works one 8-hour shift.



The relay at the left is waiting repair and the one at the right is ready to go back into service

The shop building which is of steel, glass and brick construction is 100 ft. long, and 60 ft. wide. The sash, which include most of the sides and one end, are fitted with hammered glare-proof glass. Two rooms at the rear, each 25 by 30 ft. in size, are used, respectively, for cleaning and battery overhaul. Both are equipped with monorails and an electric hoist. The remaining 60- by 75-ft. section of the shop is devoted to general electrical repairs. This section of the shop is served by a 5-ton crane with floor control. The crane has a 10-ton bridge to permit of future increase of hoist capacity. The repair section of the shop is lighted by forty-two 300-watt incandescent lamps in enameled steel RLM reflectors. All power wir-



A stator gets a new winding

ing to shop machines is run in floor ducts with steel-plate covers through which service leads are carried to the machines by flexible steel conduit.

The steel material cupboard along the back wall of the main shop

Shop Equipment

The following is a list of the major pieces of shop equipment:

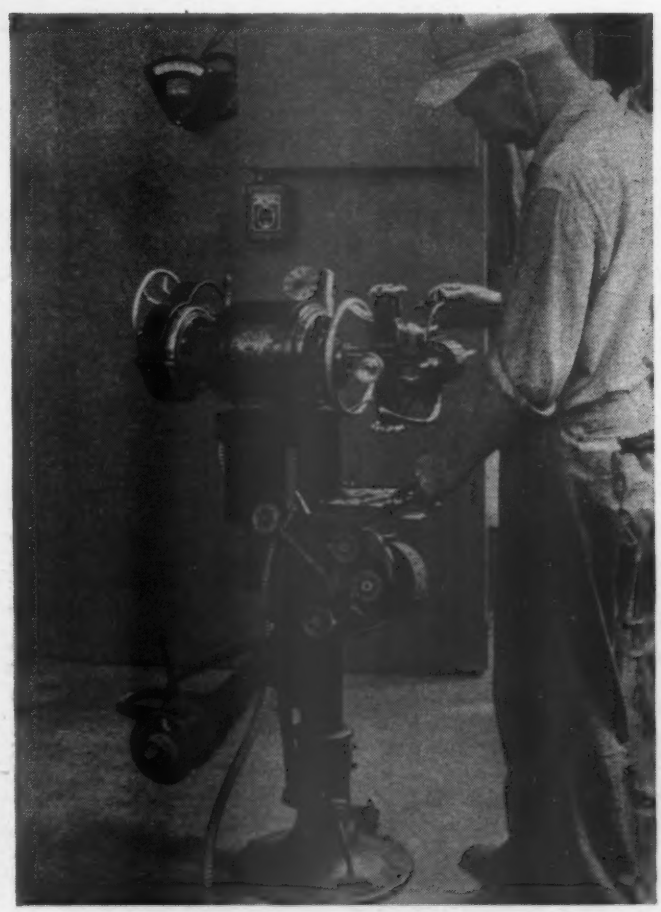
Electrically heated baking oven—54 in. wide, 80 in. high, and 74 in. deep with fully automatic control
Dipping tank
Armature and coil winding machine
Two motor-driven winding heads
Loop winder
Coil break or spreader
Two precision dynamic balancing machines for large and small armatures respectively
Sheet insulation cutter with 40-in. knife
Punch for cutting insulating washers up to 2 in. in diameter
Insulation forming machine for insulation up to 14 in. in length
Roll-type insulation forming machine for slot insulation of any length
Coil winding head
½-in. drill press
Hydraulic pipe bender
40-ton hydraulic press
Bench grinder
Coil-spring winder
Copper-bar bender
Taping machine
Flexible-shaft buffer
18-in. lathe
Motor-driven pipe-threading machine
Charging facilities for batteries
Growler
High-potential testing machine
Megger insulation tester

The armature and coil-winding machine has been found particularly advantageous for the winding of small armatures. It will wind a drum type ¾-hp. armature in 30 minutes as compared with almost eight hours required for hand winding.

Relays being overhauled at one of the benches

The lathe, which is an old one, is used mostly for armature banding. It will either be replaced with a lathe better suited to the work or with an armature banding machine. A milling machine will also be installed in the shop.

There are ten steel work benches all equipped with roller-bearing drawers. In addition to these there are four rolling tool cabinets which are used to carry tools



The armature and coil winding machine

and meters to the place at which work is being done. The meters for shop work include an ohmmeter, milliameter, and a.c. and d.c. voltmeters and ammeters. Insulation testing is done both with the hi-pot machine and the Megger tester.

The greater part of the back wall of the main shop is covered with steel cupboards. These include a stock of material which is required continuously and also a substore of material and spare parts required for specific jobs going through the shop.

In addition to the overhaul of motors and generators, passenger car lighting and air conditioning control panels are overhauled. These panels are completely stripped. All contact, bus ends, knife switch parts, etc., are cleaned with a motor-driven wire brush and all contacts are trued to insure full surface contact. All moving parts, other than contacts are also cleaned, refitted and where necessary, oiled.

Samples of the panel overhaul work done in the shop

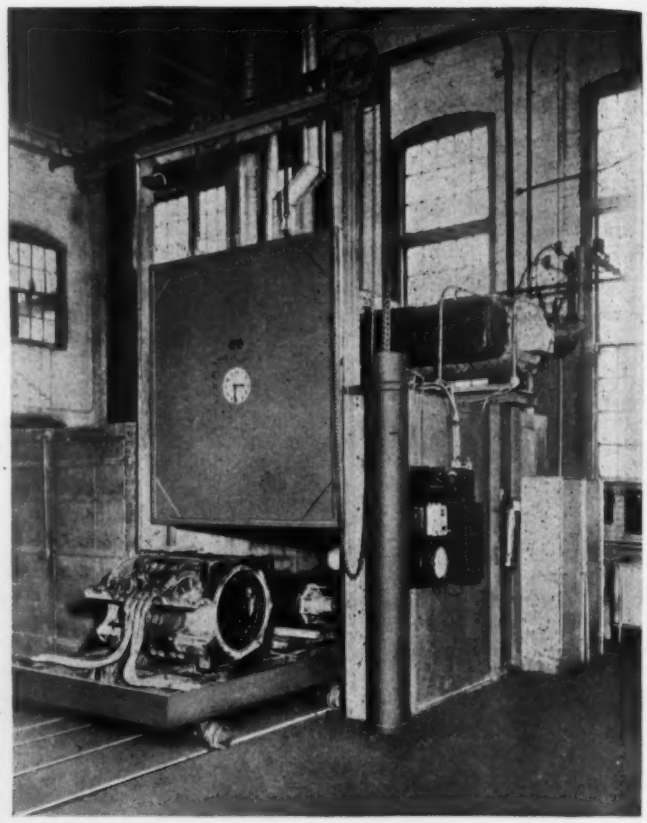
There are six electricians and one apprentice who work regularly in the electrical shop. Other men bring work to the electrical shop from the adjoining coach shop. The total number of electrical workers in the Sedalia shops is 28 electricians, seven helpers, five apprentices and seven crane operators. One machinist also works part time in the electrical shop.

Bake Oven Permits the Use of Silicones

An oven for drying and baking electrical apparatus, made by the Despatch Oven Company, Minneapolis 14, Minn., is capable of producing temperatures to 500 deg. F., with the required ventilation, sufficient for the baking of silicone varnishes. The unit in the illustration is now in use in the St. Paul shops of the Great Northern Ry., where it has served to materially reduce baking time as compared with the steam-heated brick oven which it replaced.

The interior dimensions of the oven are: width, 7 ft.; height, 8 ft., and length, 12 ft. It is gas-fired and electrically controlled. Tests show that the heat at any two points in the oven does not vary more than 4 deg. F.

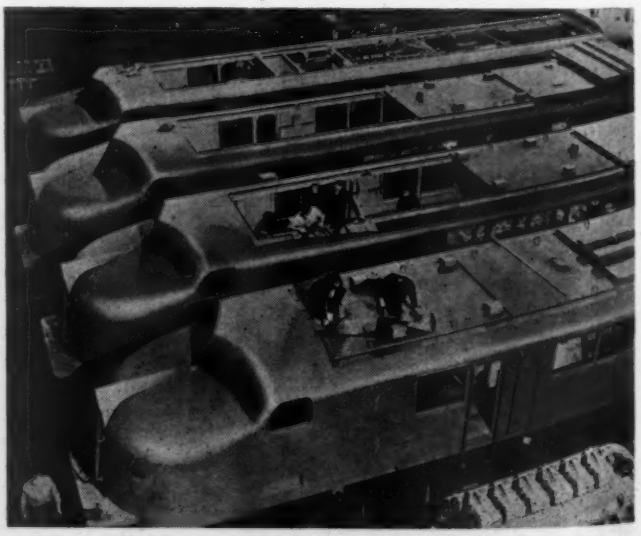
The oven has capacity for two Diesel-electric locomotive traction motors or generator armatures, and it is Great Northern practice to bake such equipment for 8 hrs. at a temperature of 265 to 290 deg. F. With the



Great Northern oven has a temperature range high enough for Silicone varnishes

old oven, it was necessary to use a baking time of 16 hrs. for these armatures. Two batches or loads are now handled in two shifts, where before it was possible to handle only one load. The day crew takes out a finished batch in the morning and reloads. The night crew takes out a batch in the afternoon and reloads, setting the oven controls to shut off when the baking is finished and leaving the fans running until morning to cool the load.

* * *



Four, of an order of twelve locomotives for the Paulista Railway of Brazil, under construction in the Erie, Pa., Shops of the General Electric Company—These are 182-ton, 3,000-volt d. c. electric passenger locomotives—They have a 2-C + C-2 wheel arrangement, a continuous rating of 4,050 hp., total length of 76 ft., with a weight of 45,000 lb. on each driving axle

An Early Start

By Walt Wyre

THE first robin had been sighted and duly reported to the Plainville paper; amateur gardeners were avidly reading seed catalogs and fishermen were oiling reels and wrapping fly rods—spring was just around the corner in Plainville. At the S. P. & W. roundhouse, Jim Evans was wondering where the next locomotive was coming from, while Ned Sparks was thinking about the approaching season for air conditioning. The season before had been a nightmare. Shortages of material, men and time had practically limited maintenance of air conditioning equipment of coaches on all but important trains to replacing blown fuses, broken belts, and cleaning screens. Passengers had for the most part accepted disagreeable conditions as part of train travel, but patience was rapidly ceasing to be a virtue. Railroad officials had already recognized that cash customers were beginning to expect better service and would get it or else, and bulletins had been issued calling attention of employees to the fact. In addition to copies of general bulletins and circular letters, Sparks had a copy of a letter from the master mechanic to the foreman suggesting that the electrician begin at once preparing air conditioned coaches that turned at Plainville.

Only one train regularly turns at Plainville. It uses two coaches, an observation lounge car, a combination mail and baggage car, and an express car. The length of the run requires two sets of equipment, making six air-conditioned cars for Sparks to prepare for service.

The electrician working full time on the cars could finish the job in about a week, but there were other jobs to be done. It was a little over two weeks until air-conditioning was to be put in operation when Sparks received the letter. He decided to start going over the equipment immediately so as to have plenty of time. He was gathering up tools getting ready to go to the car department when Evans came in the electric shop.

"There's something wrong with the motor on the fuel oil pump," the foreman said. "The hostler started to take oil on the 5081 and the motor wouldn't start. He's waiting to get it fixed and I'm in a hurry to get the engine in the house so it can be worked and turned."

Sparks reached up over the bench and got his voltage tester, pocketed pliers and screw driver, and started to leave the electric shop.

"If you can't get it going right away, tell the hostler to run the engine in the house without taking oil," Evans told the electrician.

"Okay," Sparks replied, "I'll try to get it going right away."

ALL three fuses were good and current was coming to the controller, Sparks found, but when the start button on the oil crane was pushed, nothing happened. He though perhaps there was an open in the control circuit or maybe the push button was not making contact until he short circuited the terminals in the controller and still the contactors didn't close.

"Are you going to be able to get it fixed right away?" the hostler asked while Sparks was testing. "If you're not, maybe I'd better go ahead and run her in the house."

"Just a minute," Sparks replied. "I'll find a dry stick and hold the contactors closed while you take oil. Have your helper stand where I can see him and signal when the tank is full."

While the fuel oil tank was being filled, Evans came to see about the delay getting the locomotive in the house. "Did you find the trouble yet?" he asked.

"Not yet," Sparks told him, "But I'm fairly certain the magnet coil is bad."

"Shut up!—I mean shut it off!" Evans yelled. "The tank is running over!"

Sparks released the contactors and stepped outside to see what the trouble was. The hostler was still pushing the stop button. He had forgotten about it not working.

"Another mess to clean off the tank," Evans commented sharply. "That hostler should have to clean it. Get the controller repaired as soon as possible and be sure it's working before you leave."

Sparks, using his voltage tester, found that everything was okay up to the coil, but current would not go through it. Open in the winding, he told himself, as he started removing the defective coil.

Sparks stopped at the electric shop and tested the coil again just to make certain it was open, then went to the storeroom.

"Have you got a magnet coil like this?" Sparks handed the coil to the storekeeper.

The storekeeper looked at the coil a moment and said, "Sure; how many do you want?"

"One will be enough at present," the electrician replied, "and I'm surprised to get that."

Sparks put the coil in his pocket and started back to the fuel oil pump house. When he got there two more locomotives had come in and were waiting to take oil.

"It will only take about five minutes to put in the new coil," Sparks told the hostler.

The electrician didn't look at the coil, just put it in place, fastened the clamps, and connected the wires. He closed the switch and waved to the waiting hostler.

The hostler pressed the button, the contactors in the controller closed with a bang, the motor started and almost immediately smoke started boiling from the controller case.

Sparks jumped over and pulled the main switch, then opened the controller box door. The nice new coil wasn't shiny any more, but was scorched to a blistery crisp brown.

When the oil stopped flowing almost as soon as it started, the hostler came over to investigate. "What's the matter now?" he asked.

"I think," Sparks said, "That the storekeeper gave me the wrong coil."

The electrician removed the burned coil and took it back to the storeroom. "Let me see another coil like the one I just got."

THE storekeeper handed Sparks another new coil. "Now don't come back for any more today," he said.

Sparks examined the rating tag on the coil. "Huh!" he grunted, "just as I thought! This coil is for 110 volts. I need one for 440 volts."

"That's all of that kind we have," the storekeeper said.

"Well, you had better order some more and be sure to specify 440 volts," Sparks advised.

Sparks took the coil and went to the electric shop hoping to find one there that would work but wasn't much surprised when he didn't find one. While he was searching for a coil Evans came in wanting to know if the controller had been repaired.

"No," Sparks replied. "The storekeeper had a coil but it's wound for 110 volts. I need one for 440 volts."

"Well, we've got to get the thing going some way. I can't have an electrician standing up there holding it with a stick every time an engine takes oil."

"I'll see what can be done," Sparks replied. "Maybe the old coil can be repaired."

The coil was not in condition to be repaired. There was a burned place in the winding half an inch deep. Sparks looked at the coil and scratched his head suddenly he dropped the defective coil on the bench as though it was hot and picked up the one he had gotten at the storeroom. "Gosh, I'm dumb!" he said aloud as he started back to the fuel oil pump house.

On the way he met Evans going to the electric shop to see how Sparks was getting along. "Get the coil fixed?"

"No, couldn't fix it," Sparks replied, "But I'll get the controller going."

"How will you do it?"

"Just run a 110 volt line into the controller case and put the magnet coil and control circuit on 110 volts," Sparks told the foreman.

"Well, get it going soon as you can," Evans said and turned to go back to the office.

NEXT day Sparks finished doing what jobs that needed immediate attention at the roundhouse by noon. After lunch he gathered up tools and prepared to go to the car department to work on the air conditioning. The train is due at 12:40 p. m. and being on a short run is usually on time, but he decided to ask at the roundhouse office before going down. The train was reported three hours late, having been held up at Sanford waiting for a connection from the Mountain Division. It wouldn't arrive in Plainville much, if any, before time for the electrician to quit for the day.

The fuel oil pump motor continued to operate okay until the next morning when Sparks was eating breakfast. The phone rang and the roundhouse clerk told the electrician to get the lead out and rush to the roundhouse.

Sparks scalded his throat with hot offee and hurried to the roundhouse. The trouble wasn't serious. Someone had pulled the switch of the 110-volt circuit but in the meantime five locomotives that had come in were waiting to take fuel oil.

The passenger train was on time that day and Sparks with tools ready was waiting to start to work when the switch engine shoved the cars in on the storage track. The electrician decided to start on one of the coaches that used a propane engine driven unit first. He checked the oil in the engine and was filling the radiator when the car foreman came over.

"The roundhouse clerk just called. Said for you to rush to the roundhouse, some kind of electrical trouble," he added.

Sparks swore, shut off the water, opened the drain cock of the radiator, just in case he didn't get back, gathered up his tools and headed for the roundhouse.

"Some kind of trouble at the water treating plant," the roundhouse clerk told Sparks. "Motor burned out or something."

SPARKS found the man at the treating plant all in a stew. The day before the division engineer had come in and found the place somewhat untidy. The official had left orders to have the place thoroughly cleaned. The night man had done a good job of cleaning, including thoroughly washing the little quarter-horse, single-phase motor driving the chemical pump with a stream of water while the motor was running.

Sparks took the motor off and carried it to the electric shop.

"Do you think the motor is burned out?" the treating plant man asked.

"From the way it smells, I'd say yes," Sparks replied. "I'll tell you more about it after I get it taken apart."

The treating plant man went with Sparks to the electric shop and watched while Sparks took the motor apart.

"Can it be fixed?" the treating plant man asked as he stooped to get a better view of the charred winding.

"Not without rewinding," the electrician told him.

"Can you do it?"

"Oh, I could do a fair job of winding it if I had the material and time to do it," Sparks said. "We always send our rewinding jobs to one of the electric shops that's equipped for it. I'll get this one off right away."

"How long will it take to get it back?" The treating plant man was beginning to show symptoms of being worried. "If we don't get the pump running, I'll have to put chemicals in by hand, then the water treatment won't be right, and the chief chemist will give me the devil."

"Couldn't you tell him that the motor is burned out?" Sparks asked.

"Yes, but then he would want to know how it all happened and even if he didn't blame me for it burning out, I still don't like to write letters. Can't you get it fixed up some way?"

"About the only way I could get it going soon would be with another quarter-horse motor."

"I've got a quarter-horse motor at home," the treating plant man said. "If I bring it, will you put it on the pump while this one is being rewound?"

"Sure," Sparks agreed. "I'll put it on if it will fit."

"I'll go get it now. It won't take over fifteen minutes."

"Okay," Sparks said. "I'll put this motor together and take it to the storeroom while you are gone. Bring the motor to the electric shop and I'll test it."

The treating plant man was gone over fifteen minutes but he was back with the motor in about half an hour.

"Do you think it will be all right?" he asked.

"Well, I don't know." Sparks eyed the motor doubtfully. "That's a split phase motor and they have very little starting power."

"It worked good on a washing machine," the treating plant operator said. "Looks like it would run the pump."

"Dammit!" Sparks ejaculated. "I forgot to take the gear off the other motor. Now, I've got to go to the storeroom, unpack it and take the gear off."

The motor shafts were the same size so the gear fit okay, but the holes in the base were spaced differently. The electrician overcame that difficulty by going to the carpenter shop and finding a piece of plywood 3/8 in. thick. He bolted the motor to the piece of plywood, then fastened the plywood to the bracket on the pump.

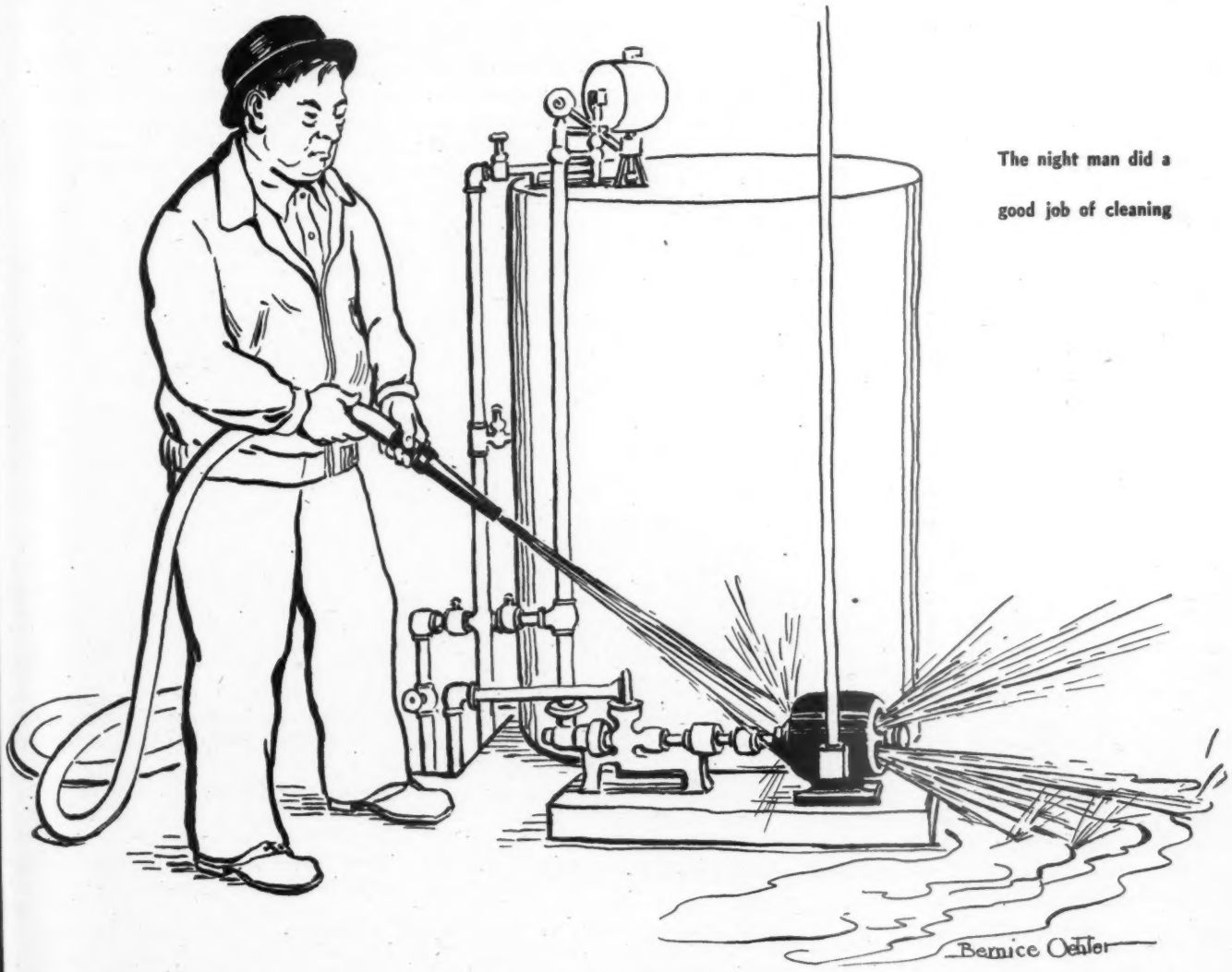
When the motor was in place and the wires connected Sparks closed the switch. The little motor grunted, turned the gears just about enough to take the slack out, then stalled.

"That's what I was afraid of," Sparks commented. "It hasn't got enough power to start the pump."

"Don't look like it would take any more power to run the pump than it does to run a washing machine," the treating plant man said morosely.

"I have an idea it would run the pump," Sparks said, "but there's quite a little drag starting that piston pump through gears. If you'll close the switch, Ill give the motor a little help to start."

When the switch was closed, Sparks gave the large gear on the pump a slight push and the motor did the rest. It ran okay and didn't get hot.



The night man did a good job of cleaning

"Let's stop it and try again," the treating plant operator said. "Maybe now that the motor is limbered up, it will start the pump."

They stopped the motor, then closed the switch, but it acted as before. "Shut it off," Sparks said, when a light haze of smoke began to curl from the motor showing that the starting winding was getting too hot.

"Looks like that's that!" Sparks commented. "Anyway, we tried."

"Well, guess I had better tell the water service foreman about it," the treating plant man said, "but I sure wish it would run."

NEXT day everything appeared to be propitious for a good start on the air conditioning. The train came in on time, in fact a few minutes ahead of schedule and the switching crew set the cars on the storage track more quickly than usual. The day was cold with a few flakes of snow in the air. The electrician decided to work inside the coach. He started with the air conditioning control cabinet.

He had removed the cover from the control panel and was examining the water pump contactors when Dick Wheeler came in. "Master mechanic wants to see you at the office right away," the car foreman told Sparks.

Sparks swore but not mildly, replaced the control panel cover and gathered up his tools.

"Too bad," the car foreman commented. "Just when you had found a nice warm place to work. But there's no rush getting the air conditioning started. The way the weather is today looks like we won't need air conditioning any time soon."

Sparks went to the master mechanic's office, spoke to the chief clerk in the main office, and started to go into the official's private office but hesitated when he saw that the master mechanic was talking to some one else.

"Come on in," H. H. Carter, the master mechanic, invited. "You know Ed Thomas, the water service foreman, don't you?"

"Yes, sir," Sparks said.

"What's the matter with the chemical pump motor at the treating plant?" Carter asked abruptly. "Ed tells me it's not working."

"That's right," Sparks nodded, "I sent the motor off yesterday to be rewound."

"What caused it to burn out?" Thomas asked.

"Well, it could have got wet," Sparks replied hesitantly. He didn't know just what the treating plant man had told Thomas and saw no point in causing unnecessary trouble.

"The main idea as I see it," Carter said, "is to get the pump going soon as possible. It's very important that the water be properly treated. We can't afford delays caused by bad water and can't spare time for unnecessary boiler washing and water changes."

"Don't you have an extra motor that could be used until the other one gets back?" the water service foreman asked.

"Afraid not," Sparks replied. "We don't use very many motors small as quarter-horse."

"Couldn't you borrow a motor from the electric power company or somebody?" Carter asked.

"Not very likely," Sparks said. "The treating plant man is anxious as anybody to get the pump running. He even brought a washing machine motor from home but it won't work, hasn't got power enough to start the pump. I'm afraid that's the only kind of motor we could borrow, if we found any at all."

"If they are both quarter-horse power motors, why won't the washing machine motor do the job?" Carter asked with a slight trace of irritation.

Sparks sighed. Then, as patiently as possible, attempted to explain why the capacitor type motor has more starting torque than a split phase motor of the same rating.

"I'm not an electrician," the master mechanic interrupted the explanation, "but it seems to me there should be some way to get the chemical pump going. Surely we are not going to take a chance on delaying a train because of foaming water in a locomotive boiler for lack of a quarter-horsepower motor. It's your baby, Thomas. If there's any trouble because the water isn't properly treated, you are the one that'll have to explain."

"That's right," Thomas agreed, "but we can't run the chemical pump without a motor. Let's go up to the treating plant and see if we can't figure out something," the water service foreman said to Sparks.

"Looks like the master mechanic was putting me on the spot," Thomas said after he and Sparks had left the office.

"Not too much." Sparks grinned. "He was just talking. I've known Carter a long time. What he said was meant as much for me as it was for you. He figured maybe I could figure out some way to get a motor for the chemical pump if I tried."

WHEN the water service foreman and electrician reached the treating plant, they tried the motor as Sparks had the day before and with the same results. Thomas looked around a bit trying to figure some way the pump could be belted to the main pump motor shaft but without success. The chemical pump motor operated only at intervals controlled by a timing device on a water meter. When each thousand gallons of water passed through the meter, contact was made and the chemical pump motor started. A timer determined the running time of the motor for each thousand gallons of water, and thus regulated the treatment.

"If the chemical pump ran continuously, I could figure out some way to belt it to the main pump motor," Thomas said.

"If it ran continuously, we could use the washing machine motor," Sparks said. "We could give it a little help starting and then it would keep running."

"I still don't understand the difference between the two motors," Thomas said. "I was trying to follow you when you were explaining, but Carter interrupted."

"Well, I'll try to explain the best I can," Sparks said and started to do so. He was saying, "A capacitor motor has a capacitor or condenser connected in the starting winding which causes the current to be out of phase with that of the running winding, creating essentially a two phase motor while starting—" Suddenly, Sparks stopped talking.

"Go ahead—I'm listening even if I don't understand much of what you are saying."

"But I've got an idea," Sparks said. "It might work! I'll be back in a few minutes."

Sparks tore back to the electric shop and started When Sparks reached the electric shop, he started loosening screws to remove the end bell from the motor. Using the short pieces of wire he brought two leads out of the motor, then replaced the end bells.

"What's that thing?" Thomas asked when the electrician using tape fastened a capacitor to the motor.

"It's a capacitor. I'm connecting it in series with the starting winding, and hoping it will make the motor start the pump."

When the job was finished and the switch closed, the motor started right off. The capacitor had increased the starting torque, not much, but enough for the job at hand.

"Well, if that's the only difference between a split phase motor or whatever you call it and a capacitor motor, looks like you would have done that at first," Thomas commented.

"Well, to tell you the truth, I didn't think of it. Besides I wasn't certain it would work. You see, regular capacitor motors have heavier wire in the starting winding than split phase motors, but anyway, lucky for us, this one didn't need much extra kick. Let's try it again."

"Looks okay to me," Thomas said. "Let's go tell the master mechanic about it."

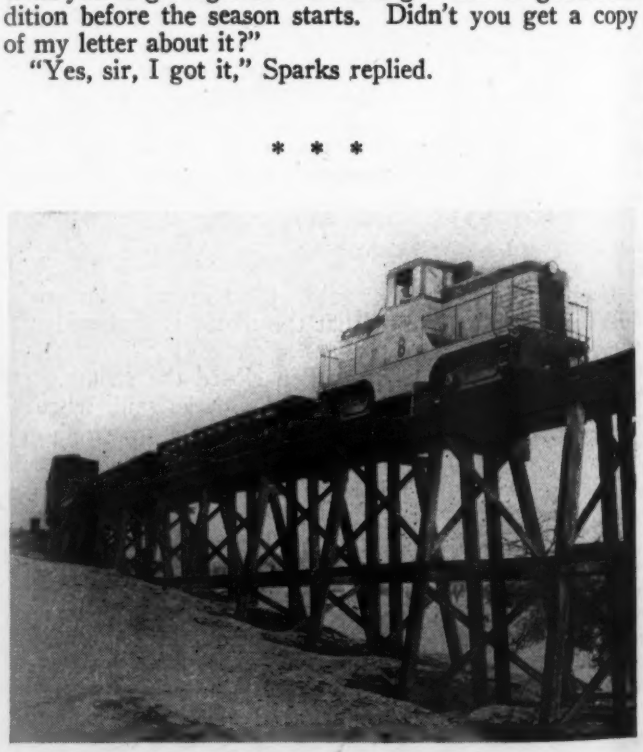
"I figured maybe if you tried hard enough you'd get it going," Carter commented. "What have you done on the air conditioned cars?" Carter turned to Sparks.

"Very little yet," Sparks replied.

"Well, it's not long now until they'll be needed. I want you to get right on them and get them in good condition before the season starts. Didn't you get a copy of my letter about it?"

"Yes, sir, I got it," Sparks replied.

* * *



This 44-ton Alco-G. E. Diesel-electric locomotive, in operation since June, 1945, replaced a steam locomotive on the Amador Central. Its availability has been 99 per cent and it has shown a saving of 75 per cent in fuel expense. Maintenance has also been unusually low. This 11.8-mile line from Martel, Calif., to Ione, has grades up to 4 per cent and 23-deg. curves with 252-deg. curvature per mile of road

NEW DEVICES

Improved Electroplating

An electroplating process in which finishing costs are reduced 20 per cent or more while the resulting product has better quality and a finish fully equal to that produced by older methods has been developed by the Westinghouse Electric Corporation. In the new plating process, current is reversed periodically to remove surplus or unsound metal, level peaks, and polish. Loose or surplus plate is "wiped" off by these electrical backstrokes leaving only the smooth, tightly fastened atoms. Successive layers of plate can be built up by this method to almost any desired thickness to make a deposit more dense and of greater homogeneity than that possible with conventional continuous-current methods.

The magnet on the left was direct-current, rack plated for 5 hours, the one in the middle was direct-current, barrel plated for 7 hours, and the one on the right was Periodic Reverse-Current plated for 4 hours. None has been polished

Using the Periodic Reverse-Current method, it is possible to produce a plate that is considerably smoother than the surface of the material to which it is applied. For example, a film of copper only .0015 inches thick has been plated on shotblasted steel with no evidence of the rough base metal being apparent at the surface of the copper plate. Burned electrodeposits, nodules, exaggerated buildup of metal at corners or at sharp points can be reduced or eliminated when the new process is used.

Greater speed is obtained because stronger current can be used in the plating portion of the cycle. Since the metal surface is brightened by the current reversal, hand buffing or polishing can be cut down or eliminated entirely in many cases.

The new process works better with some electrolytes than with others. Plating baths best suited for its use are the cyanide-type baths such as copper, silver, zinc, cadmium and even gold. In general, definite and substantial improvement is evident with the new method in most acid and alkaline electrolytes. Such factors as temperature, metal concentration and alkalinity or acidity of the solution must be carefully studied to obtain the best results for each adaptation.

Ceco-Drop Drop Hammer

A gravity drop hammer which requires neither boards nor other form of friction lift has been designed by the Chambersburg Engineering Company, Chambersburg, Pa. Known as the Ceco-Drop, it may be operated by either air or steam and may be had in sizes from 50 lb. to 20,000 lb. By using a piston lift the speed restriction in the up stroke imposed by the boards is eliminated and the striking of more blows per minute is made possible. Because of this greater frequency of blows, the forging temperature is higher and it is said that fewer blows generally are required.

The hammer is operated by depressing the treadle which acts directly on a pilot valve to release the rod from the positive-gripping clamp and permit the ram to fall. As long as the treadle is held down the clamp remains in the non-grip position permitting the ram to repeat its blows, but in the event of an air-supply failure, the clamp will grip the rod automatically. The air or steam that operates the piston is used expansively by shutting off the supply part way up on the upstroke to attain greater efficiency in consumption. The valve is placed on its side to attain greater accuracy and speed of operation. Air consumption is 11 cu. ft. at 100 lb. per sq. in., requiring about 1.6 hp. for each 100 lb. of falling weight. The length of stroke of the ram can be changed in less than a minute, by removing the dog-locating pin, moving the 1-lb. dog to the new location and re-inserting the pin. A control valve is included in the supply ports to permit the operator manually to control the ram for blocking or unblocking.

Maintenance of the Ceco-Drop is simplified by having 22 per cent fewer parts than a comparable board drop hammer and because there is no adjustment to be made of any friction-lifting mechanism. There are no belts or motors and the power source can be located well away from the vibrations of the forge shop. Rods, which are estimated by the manufacturer to have a life of 200 hr. or more of actual production, can be changed in one half hour.

Adjustment of dies and of frames is no different from practices on board drop hammers. Since the guides are hardened and parallel, replaning of the ram is anticipated to correct for wear. In such cases the wearing plates between the yoke and the frames must be appropriately sized to maintain the central position of the cylinder. As valve travel is important, the dog faces are hardened for long wear and should be replaced when worn to the extent that valve travel is reduced 1/16-in. The shoes of the clamps are expendable, and new ones can be inserted without disturbing any other part of the hammer. The cylinders can be readily replaced when worn beyond economical use.

The clamp assembly consists of a carriage pivoted from the yoke at one end and connecting through levers to an air cylinder at the other end. In the carriage are two clamping blocks pivoted on pins and containing removable faces which clamp the rod. The entire clamp assembly

The feeding and working zone of the Ceco-Drop is clear and free to the operator

is mounted so as continuously to touch the piston rod. This continuous contact aids in dampening vibrations in the rod.

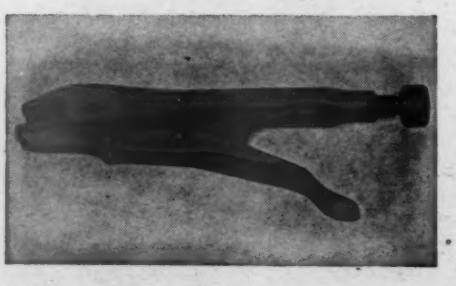
The operating control consists of a rocker pivoted on the right-hand frame. On this rocker are mounted adjustable dogs which receive inclined actuated movement from the ram to oscillate the rocker. The upper end of the rocker is connected by levers to the operating valve. The first connection is extended into the path of the ram as a safety measure in case the dogs are not in place. Bearings of the lever system are cushioned against shock by appropriate Neoprene or equal bushings.

The frames are V-sections with the point of the V forming the guides. They are made of Cecolloy, are heavy and have a low center of gravity. The guide surfaces are made parallel and are hardened electronically. The yoke, also made of Cecolloy, is mounted on the frames and held by inclined bolts. It is positioned with respect to the frame by wearing plates, located by the tie bolts, abutting the adjacent surfaces. The yoke forms the valve chests and ports, and contains the stuffinng box of the piston rods. The cylinder is inserted into the yoke and has a safety cylinder on top as a safety measure when rods break. The anvil assembly is similar to that used on a board hammer.

The ram is a heat-treated steel forging and the rod is of heat-treated alloy steel. The steel piston is shrunk on the upper end of the rod and is fitted with heat-treated alloy-steel piston rings. The lower end of the rod is tapered to receive a split tapered bushing. The rod and bushing are inserted into a corresponding taper in an alloy-steel socket keyed in the top of the ram. The entire hammer assembly has a low center of gravity as it was felt that the nearer the center of gravity of a hammer assembly is to its foundation, the less is the loss of energy through movement and vibration. In the 2,000-lb. Ceco-Drop the center of gravity of the hammer at impact is approximately 10 in. above the die line, or about half the distance of comparable board drop hammers.

Lock Wrench

A locking hand-wrench said to have a gripping strength equivalent to one-ton pressure is manufactured by A. C. E. Incorporated, Transportation Building, Detroit 26, Michigan. It is designed for use as a clamp in such operations as welding and soldering, pattern making, removing stubborn bolts or cotter pins, and for wire bending or splicing operations.

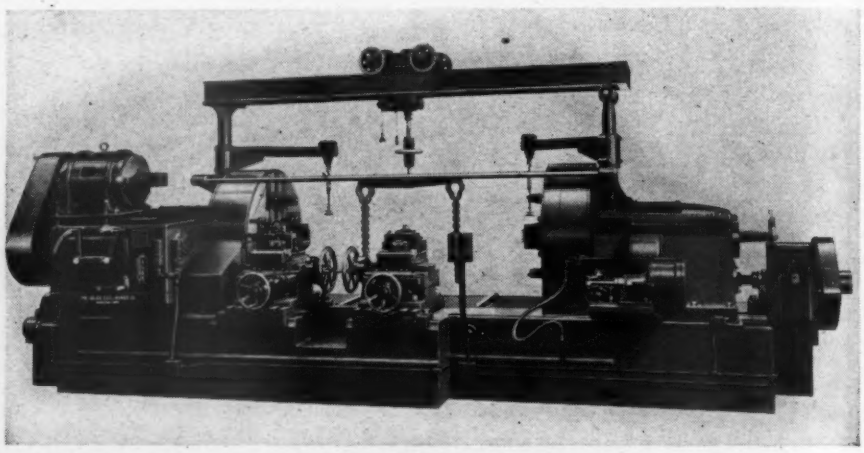


Locking hand wrench with a maximum jaw opening of 1¼ in.

The wrench is made of alloy steel, cadmium plated, and is 10 in. long. The double-lever or toggle action permits it to be used as a combination straight, end or pipe wrench, vise, toggle press, clamp or pliers. Parts up to any size which will fit the maximum jaw opening of 1¼ in., can be held by the wrench for tooling, drilling, grinding or machining.

Car-Wheel Lathe

The Niles 52-in. car-wheel lathe is designed for heavy-duty operation with modern high-speed tool steel and is equipped with several late and improved time- and labor-saving devices by the manufacturer, The General Machinery Corp., Niles Tool Works Division, Hamilton, Ohio. It will turn wheels with tread diameters from 26 to 52 in. equipped with plain or roller bearings, inside or outside journals.



The Niles 52-in. car-wheel lathe

For turning car wheels on axles having outside journals, the axle is chucked by collapsible bushes which fit into taper sleeves within the spindles. The wheels are brought close to the faceplates and gripped by the automatic equalizing drivers which engage the tires near the rim. When turning wheels on axles having inside journals, the pointed centers are employed and the wheels gripped by the drivers in the usual manner. Trailer wheels having outside journals of larger diameter than the ordinary axle may also be turned on the pointed centers. A calipering device, consisting of an adjustable pointer on a bar which is rigidly supported on the headstocks, is installed to enable the operator readily to size both wheels to equal diameters.

The distance between faceplates varies from a minimum of 6 ft., 10 in. to a maximum of 10 ft., 5 in. The lathe will take journals up to 7 in. diameter with the collapsible bushes and up to 11¾ in. diameter by chucking with the pointed centers. With a d.c. motor drive the speeds to the faceplates range from .76 to 2.28 r.p.m.; the a.c. drive gives six speeds varying from .77 to 2.32 r.p.m. Where the use of carbide cutting tools is desired, a faster speed range may be had on special order. There are six feeds ranging from 3/32 to 9/16 in. per revolution, while eight strokes per revolution make the feed practically continuous. The feed ratchets are entirely enclosed and operate in either direction.

The machine has two massive heads mounted on a heavy bed of deep box section to which the left-hand headstock is rigidly bolted. The right-hand headstock has a power traverse and is operated by a separate motor located at the end of the bed. The forward movement of the headstock is through a friction disc to eliminate the possibility of damage by the faceplates being brought up too forcibly against the wheels. The backward movement of the headstock is positive, the drive being by means of a ratchet arrangement and the travel limited by an electric safety switch. The headstock is adjusted to a sliding fit and is securely clamped back and front to the bed by means of a pneumatic clamping device.

Each headstock is equipped with a heavy faceplate carried on an extra large spindle, the end thrust of the spindles being taken by ball bearings. The faceplates are provided with T-slots and each is equipped with four Niles equalizing drivers which engage the wheels near the rim and hold them rigidly to the faceplates. Wheel sets equipped with anti friction bearing housings can be turned on centers with the standard height of drivers, the faceplates having openings of sufficient size to receive these housings. Inserts are provided for the openings and are accurately located in position in the faceplates. The smallest wheel set equipped with anti-friction bearing housings that can be chucked with the standard driver is 33 in.

The tool rests are equipped with turret tool posts which consist of four-sided rotatable tool blocks mounted on the lateral feed slides. The turrent tool has four turning tools rigidly mounted in the tool block but easily removed for grinding. The tool block is clamped to the lateral slide by a heavy central bolt and locked in the proper cutting position for each tool by the indexing cam lock. The block rests on a ball thrust bearing and coil spring which allows indexing with very little manual effort.

The tool rest is adjustable both in and out by a rack and pinion for different-sized wheels. The rest is made to swivel, but it bolts to a rack which slides in a T-slot in the base to give in-and out move-

ment of the rest without disturbing its angular setting. A hardened and ground steel plate is attached to the underside of each turrent for indexing the turret. The center clamping bolt has a ball thrust bearing with a spring, which, when the clamp nut is released, absorbs most of the weight of the turret and facilitates indexing. The tool blocks carry four tools, each of which is indexed into correct relation to the wheel with a minimum of lateral traverse. The tool blades are clamped to the tool blocks, thus permitting quick replacement.

The feed ratchets for lateral power feed are completely enclosed and convenient to operate. Fast hand traverse is also provided for both cross and lateral adjustment through large hand wheels. The tool slides are arranged for the application of power traverse. The final setting of the tool into the tread for depth of cut is made by a wrench through reduction gears. Ball thrust bearings are used on the feed screw for easy adjustment.

All driving gears on both headstocks are alloy steel, herring bone, except the faceplate gears which are spur type. The speed-change gears on the left-hand headstock are also of alloy steel and enclosed in a separate unit. All gears are either enclosed or covered with suitable guards. All of the running parts are lubricated by an automatic pressure system to provide a continuous supply of oil to all gears and bearings. A pressure switch is included for stopping the drive should the oil pressure drop below the pre-determined minimum. The faceplates gears and pinions are lubricated with heavy grease. All important sliding surfaces have renewable steel wear plates.

Ready-Cut Paper Masks

A gum-backed stencil for lettering or applying designs on rolling stock is available from the C. O. Dicks Company, 8544 Grand River, Detroit 4, Mich. This stencil is said to produce sharp clear designs or lettering with the abscence of any marks left by ties which are common to the ordinary stencil. It is also said to provide durability by making the decoration and the body finish one and the same, and not something stuck on which needs protection.

To use this lettering device a coat of stickum is applied to a clean surface by means of a clean paint brush, and ten or fifteen minutes allowed for the stickum to dry. Then, until pressure is applied, the stencil can be slid into position without grabbing or seizing. When the stencil is porperly located a slight pressure with the thumb or fingertips will hold it in position. The stencil is then patted down with a hand or scrub brush and the ties removed with a sharp knife or razor blade. Application of the stencil is completed by rubbing it down with a dry stiff scrub brush to seal the edges of the letters, after which the stickum from the openings is easily rolled up and removed.

The letters may be applied by either a spray gun or a paint brush. After the letters are applied the stencil may be

The gum-back is easily removed

removed at any time, but if the paint brush is still wet, care must be taken to prevent the stencil parts from falling into the wet letters. The letters centers are picked out with a knife point.

Multi-Speed Gear Transmission

A selective sliding-gear transmission for application to milling machines, lathes, shapers and other shop machinery has been developed by the Turner Uni-Drive Company, 3416 Terrace street, Kansas City 8, Mo. It is available in four sizes from one to ten horsepower and in various models in each horsepower range. These models have either 3, 4, 6 or 9 output speeds with overall speed ratios of 3, 3, 4.8 and 9.5 to 1 respectively.

Two handles control the output speeds and are interlocked to prevent setting in two speeds at once. Belt adjustment is provided by an adjutable motor plate between the motor and the transmission, and by a bracket hinge mounting between the transmission and the machine.

The Uni-Drive is housed in an aluminum-alloy case and has precision-ground, eight-spline chrome-nickel-steel shafts that turn in anti-friction bearings. The hardened-steel gears operate in an oil bath. To eliminate leakage around ground shafts and shifter-handle rods, Garlock Grease Seals are applied. For users that

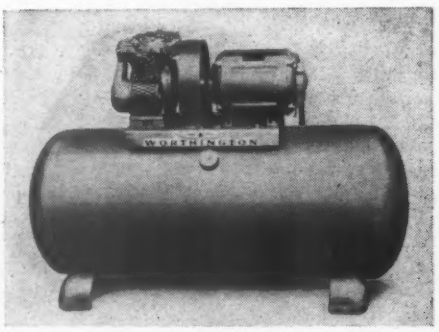
The Turner Uni-Drive applied to a lathe

desire a lower speed than is attainable from the standard models, a slow-speed series is available and has one additional reduction 50 per cent slower than the lowest speed in the regular units.

Air King Compressors

A line of air compressors designed around established motor horsepowers has been announced by the Worthington Pump & Machinery Corp., Harrison, N. J. Designated as the "Air King", this line includes single-stage and two-stage sizes for pressures up to 250 lb. per sq. in. for mating to standard motors of one to fifteen horsepower. The types include self-contained power-driven models mounted on bases or tanks and bare compressors for either direct or V-belt connection to the prime movers.

These compressors employ a centrifugal clutch for automatic starting which permits the driving motor to attain full speed before the compressor turns. This eliminates the



A self-contained model of Worthington Air King Compressors

need for starting unloaders, check valves, release and bleeder valves, etc. The direct power drive eliminates transmission losses and drive adjustments. To assure safety and cleanliness, guards are used to enclose all moving parts.

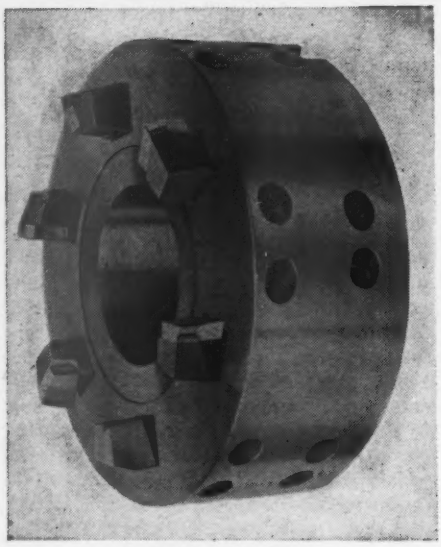
Cutsall Face Mill

The Cutsall is a face mill designed for modern milling practice. It is a tool-bit-type mill with Carboloy blades.

The housing is built to take either left- or right-hand blades. It holds the blade face slightly back of center so that positive and negative radial rake can be obtained from the same blades. There are two set screws for each blade, one of which bears on the tapered base of the blade and provides for fine blade adjustment; the other is to lock the blade securely in the housing.

The blades have extra large Carboloy tips and can be sharpened on an off-hand, adjustable-table single-point tool grinder exactly the same as regular lathe tools. The overall construction of the Cutsall is rugged and balanced and it can make heavy cuts in tough stock at high spindle speeds.

It is available in 6-in., 8-in., and 12-in. diameter sizes from the Lovejoy Tool Company, Springfield, Vermont. For conven-



The Cutsall face mill

ience and economy one size of Carboloy tipped blade fits all four cutter sizes. The blades are tipped with either of two grades of Carboloy, one for cutting steel or one for cutting cast iron and non-ferrous metals.

Self-Regulating Generators

Self-regulating generators for standby or emergency Diesel-electric power plants are now being offered in 7.5- and 10-kva. sizes by the Witte Engine Works, Kansas City, Mo. No rheostat is required and the control has no moving parts.

The voltage output of the generator is regulated within narrow limits by varying the exciter voltage input to the generator electrically. Near-resonant reaction from a magnetically saturated reactor connected in series with a capacitor provides an a.c. voltage that amplifies small changes in generator voltage.

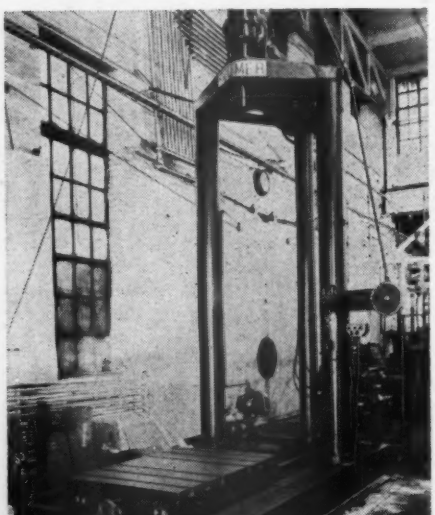
This a.c. voltage is rectified and combined with the input voltage of the excitor to hold the generator voltage within 2 per cent plus or minus from no load to full load. It also compensates for voltage changes caused by variations in speed of the engine. No tubes or other delicate parts are required.

Honing Machines

A range of honing machines said to accomplish internal cylinder honing quickly and economically to an accuracy of .0002 in. is available from the C. Allen Fulmer Company, 1217 First National Bank Building, Cincinnati 2, Ohio. These machines use conventional honing heads that carry abrasive stones which can be diametrically expanded. They have all operating controls within easy reach of the operator at all times. Easy setting of the length of stroke, by-passing for hone withdrawal, and short stroking at any point within the stroke setting can be controlled from the front of the machine. Rotation or reciprocation of the spindle, independently of each other, is obtained by push buttons on the control panel, as is simultaneous reciprocation and rotation of the spindle for the honing operation.

A feature of these machines is the patented Fulmer "Stop and Dwell" system which permits honing up to internal shoulders or to the head end of blind cylinders. The spindle can be stopped in any point within the range of the machine without shock or impact. When stopped, and under time control, the reciprocating mass is held in position at that point on a "locked-in" column of oil. The operation of this system is controlled by a selector switch and the control panel which sets the dwell interval to a period of from 1 to 30 seconds.

The entire reciprocating mass is hydraulically counter-balanced at all times. The spindle drive motors are equipped with magnetic brakes to prevent coasting of the spindle. The spindle drive and gear-box train on all sizes of machines are the same and are designed to transmit four times the



One of the large size Fulmer honing machines equipped with a sliding table for the rigid handling of work pieces

power input necessary to hone the largest-diameter cylinders that can be handled on the largest model. These machines were engineered to handle these much greater loads than can be imposed on them, to assure low upkeep under the most severe operating conditions and to provide ample power to permit the honing stones to remove the material by cutting rather than by rubbing it off the bore.

These machines are available in three sizes with maximum honing capacities of 10, 15 and 20-in. cylinder diameters and with standard strokes of 25-, 36- and 48-in., respectively. Reciprocating speeds vary from 0 to 75 ft. per min. on the two smaller models, and up to 60 ft. per min. on the large model. Sliding work tables can be supplied for easier and more rapid handling of large cylinders. The sump tank is installed so that it can be quickly removed for dumping and cleaning without delaying production. The coolant overflows from this tank into two large settling chambers with large cleanouts, so that when the sludge tank is dumped, the coolant in the remainder of the system is not lost.

Motor for Pump Drives

A hollow-shaft vertical motor designed specifically for pump drives has been added to the line of General Electric Tri-Clad induction motors. It is available in ratings from 1 to 500 hp. at all speeds and frequencies.

For motors rated 10 hp. and larger, the line features a system of controlled lubrication which allows just the right amount of oil to flow through the bearings, and thus prevents oil-friction loss caused by foaming and churning. Bearings are protected from rust even during standby periods because the oil level is above the top of the balls.

A large oil reservoir cast integral with the motor end shields has sufficient capacity to allow the oil to cool and recover before being recirculated. A close-running fit between the end shield and couplings protects bearings and oil reservoir from the entry of dirt even when the top cap is removed for pump adjustment. The smaller motors have grease-lubricated bearings.

Bearings, punchings, and windings are effectively cooled by a double-end ventilation system which draws in air at both ends of the motor and discharges it through openings in the stator frame. A protective "self-release" coupling prevents damage to the pump or motor caused by motor reversal. This consists of a top half-coupling keyed to the pump shaft and a lower half-coupling keyed to the motor shaft. It reduces installation time and provides a simple method of checking motor alignment.

The sturdy, light, top cap is easily removed, making the coupling conveniently accessible. When impeller adjustments are required, one person can remove the top

One of the smaller vertical induction motors

cap without the aid of rigging. The motor can be lined up accurately and easily from the top. Adjustment of the pump shaft is accomplished by means of the locking nut on top of the coupling.

Rotor windings in all ratings provide suitable starting torque with the low starting current needed for full-voltage starting. The hollow shaft is accurately bored and has ample thickness to insure rigidity. The outside diameter of the rotor is accurately ground, and the complete rotor is dynamically balanced, thereby reducing vibration and bearing wear.

Safety Goggle Cleaning Station

A safety-goggle-cleaning station which can be attached to the wall at strategic locations throughout plants is announced by the American Optical Company, Southbridge, Mass. As a constant reminder for

Cleaning station for safety goggles

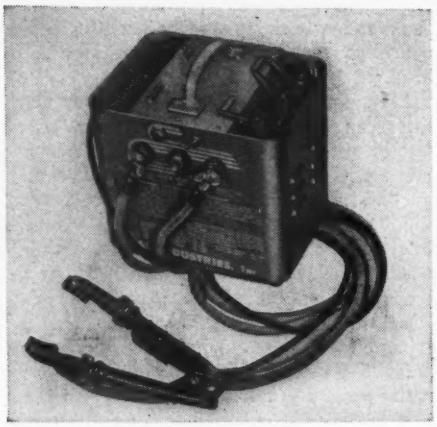
workers to keep their goggles clean, the lens-cleaning cabinet reduces the possibility of accidents or spoiled work caused by blurred vision.

Made from selected hardwood, in safety green color with a smoothly lacquered finish, the cleaning station is designed in a small, compact unit with provisions for all necessary cleansing and anti-fog materials. It is 13 in. long, 9 in. high and 6 in. deep. Directions for using the goggle cleaning station are printed on the front panel of the cabinet. Supplies of the necessary lens-cleaning fluid, cleaning tissues and anti-fog compound for reducing fogging, steaming and frosting of lens surfaces are also obtainable from the optical company.

Electric Soldering Tool

The Thermo-Grip soldering tool, manufactured by Ideal Industries, Inc., Sycamore, Ill., has been completely redesigned. Operating on the resistance heating principle, the same as the previous models, the new unit heats 20 per cent faster, has a thumb switch for close heat control, has improved design, is lightweight, compact, portable and can be used for long periods of time without overheating.

The complete unit includes a transformer or power unit and a soldering tool that operates like a pair of pliers. Holding the work with the tool completes the trans-



The soldering tool as connected to the pliers—A soldering pencil and fork are shown in the compartment at the right

former secondary circuit and causes the work to heat instantly. No preheating is necessary. Heat is produced between the electrodes of the soldering tool only, thus concentrating it on the exact spot needed, without danger of melting nearby joints or burning other parts.

The handles of the tool are made of lightweight plastic. Radiating fins isolate the meehanite jaws from the handles to prevent excessive heat conduction. The "plier" can be locked in any position for special applications by a tightening screw at hinge. Secondary leads, made of flexible power cable and insulated with lightweight woven asbestos, are attached to the side of the jaw for easy handling and cooler operation. The tool is especially suited to removing or applying solder lugs, sweating and unsweating copper pipe and fittings, soldering wire joints, etc.

Other types of soldering tools include a "pencil" for spot soldering, and a "fork" for soldering in restricted places.

The unit is rated 1,000 watts. The case measures 10¾ in. x 8 in. x 10⅜ in. All parts tuck away in it when not in use.

Hydraulic Grinding Machine

Designed for precise center-type grinding operations on small diameters, the Cincinnati Filmatic 4-in. plain hydraulic grinding machine, built by Cincinnati Grinders, Inc., Cincinnati, Ohio, can be provided with hand or automatic hydraulic infeed mechanisms which give the machine high productive capacity for either traverse or infeed types of operation. The machines are available in 4-in. by 12-in. and 4-in. by 18-in. sizes. Controls are conveniently placed and easy to operate and, if desired, the kneehole in the front of the bed permits the operator to be seated while working.

The hand traverse has a two-speed arrangement to permit rapid positioning for set-up purposes, or slow hand adjustment for shoulder grinding. Power table traverse is hydraulically actuated and rates are infinitely variable from 3 to 280 in. per min. under control of a single selector knob. An independent truing rate of 2 in. per minute is selected by pushing the rate-selector knob inward, thus permitting the grinding wheel to be trued without disturbing the traverse rate setting.

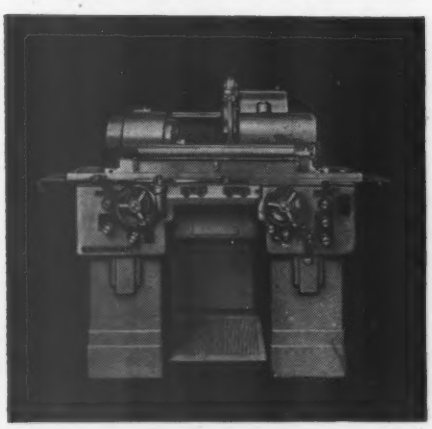
A single lever control starts the power table traverse, and simultaneously starts the headstock rotation and coolant flow. The direction of table motion is controlled by a two-position reverse lever which may be operated by hand or by adjustable trip dogs on the front of the table. The dog-operated table reverse is accurate within .001 in., a desirable feature when grinding close to a shoulder. Dog-controlled table reciprocation may be accomplished with a stroke as short as 1/16 in. to create an effect similar to grinding-wheel spindle reciprocation, or, in conjunction with the automatic pick-feed mechanism, to simulate infeed grinding on short work.

The table may be made to tarry or dwell from 0 to 5 seconds at each reversal, under the control of a single infinitely adjustable selector knob.

The hand-traverse handwheel becomes inoperative and remains motionless when power traverse is engaged. The enclosed motor is carried on a vibration-proof, hinged-type mount with a rapid, one-hand positioning knob to simplify speed changes and belt tension adjustments. The spindle rotation is instantly stopped when the motor stops by a spring-actuated shoe-type brake, which remains engaged at all times when the spindle is not running. A single release knob permits the brake to be released momentarily or locked out if desired.

A live spindle headstock is available for jobs which require this style of drive. This headstock may be provided with draw-in collets or a chuck. An adapter plate permits a center to be mounted when necessary.

The footstock of standard machines has a combination lever and screw-type retraction



The Cincinnati 4-in. plain hydraulic grinding machine

of the spindle. An automatic, hydraulically actuated unit can be applied to the footstock of machines equipped with hydraulic infeed mechanisms. This attachment advances and detracts the center in synchronization with the operation of the infeed cycle. The grinding-wheel spindle is mounted in Filmatic bearings to assure absolute dead-center rotation of the spindle. They are self adjusting for load variations to permit heavy stock removal or fine finishes to be attained with equal ease. The spindle bearings are completely submerged in oil at all times and are protected from accidental neglect by a float-actuated

switch which shuts off the grinding-wheel drive motor before the oil level falls too low. The grinding-wheel mount and the driving sheave are exceptionally close to the front and rear bearings, respectively, to provide maximum rigidity.

Two V-belts transmit power from the motor to the spindle. The sheaves have four grooves in two diameters and the belts can be readily shifted from one diameter to the other. This arrangement permits the grinding-wheel speed to be increased at the 13-in. worn-wheel diameter (new wheels are 16 in. in diameter), thereby maintaining efficient grinding action. After the belts have been changed to the high-speed drive for worn wheels, a safety interlock prevents the operator from mounting new wheels on the spindle until the belts have been changed back to the proper step on the pulley.

Standard machines have an automatic pick feed for traverse grinding and a hand cross feed of the wheel-head unit for set-up adjustments. The infeed handwheel, equipped with a micrometer dial graduated in increments of .001 in. diameter reduction, traverses the wheel head .050 in. per revolution. Fine cross adjustments of the wheelhead are made by pulling outward the handle portion of the handwheel, after which one full revolution of the handwheel reduces the work only .001 in. on the diameter. An index plate, having ten equally spaced notches into which the handle may be engaged, permits accurate reductions in work diameter of only .001 in. with the comparatively large handwheel movement of one-tenth of a revolution.

A unique built-in positive stop arrangement may be used accurately to limit the infeed rotation of the handwheel for accurate sizing on repetitive cuts. The stop operates in conjunction with the infeed micrometer dial so that the dial will be in zero position when the stop is fully engaged. This permits size compensations to be made by repositioning the dial the desired amount and again feeding in to zero against the stop. The stop is automatically disengaged when the grinding wheel is backed away.

An automatic pick-feed mechanism provides automatic infeed of the grinding wheel at each reversal of the table when traverse grinding. The amount or rate of pick feed, selected by a single knob, is graduated on a dial having ten graduations, each of which represents .005 in. of stock removal on the work diameter. The pickfeed mechanism is engaged and disengaged by means of a small clutch lever, and each new pick-feed cycle is started merely by pushing a button.

Both hand infeed and traverse grinding operations can be greatly expedited by the addition of the hand hydraulic infeed attachment. It gives a rapid, hydraulically actuated advance and retraction of the wheelhead unit, adjustable from 3/16-in. to 1-in. stroke, under the control of the cross-feed handwheel. The first partial movement of the handwheel to feed the grinding wheel inward engages the hydraulic rapid advance and, thereafter, the function of the hand infeed, by itself or in conjunction with either the positive stop or the automatic pick feed, remains the same as the standard machine. After grinding, the first partial rotation of the handwheel to back the wheel away engages the rapid hydraulic retraction movement of the wheelhead.

Plunge-cut jobs occurring in large quantities can best be performed with a completely automatic infeed cycle, provided by the addition of the automatic hydraulic infeed attachment. The cycle, started by a single lever, consists of rapid advance wheelhead, feed to depth, tarry, and rapid retract wheelhead. Once started, the cycle is completely automatic and permits the next piece to be dogged while the machine is grinding. The attachment incorporates a "runahead" feature which compensates for variations in grinding stock on the work.

Lube-A-Plane

The Lube-A-Plane is a portable oil-dispensing unit for pumping lubricating oil into stationary and mobile equipment that is adaptable to the dispensing and flushing of engine oil in the crankcase of Diesel locomotives. It is said to permit operation at summer or winter pumping temperatures down to 10 deg. F. without heating and to develop pressures up to 200 lb. per sq. in. through its steel fitted internal-gear pump. The lubricating oil is drawn off by a single attendant who controls the flow of oil from the pump at the nozzle. The delivery line has a bypass valve leading back to the suction side of the rotary pump so that the motor need not be shut down when the shutoff valve is closed.

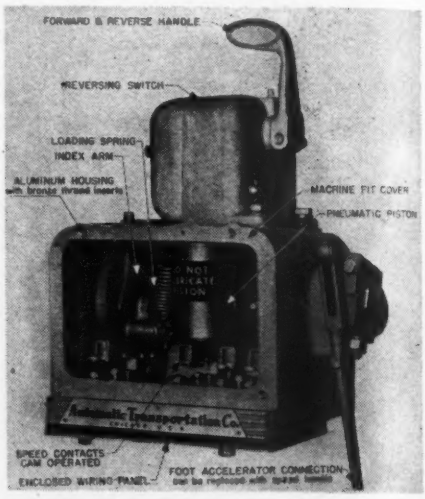
Tank model of the Lube-A-Plane

The tank-type Lube-A-Plane has a single-piece forged-steel chassis arc-welded into one rigid unit. This chassis anchors the heavy-gauge steel tank, which is available in capacities ranging from 50 to 300 gallons. The tank has a 12-in. expansion dome and a 6-in. hinged cap, which is fitted with a triplex vent and spring loaded to provide adequate expansion relief area in case of fire. Disc-steel wheels with Timken roller bearings and pneumatic tires on steel rims enable the attendant to move the Lube-A-Plane from place to place, manually or by tractor. The standard trailer is equipped with a demountable, self-contained pump and manfold unit complete with suction and discharge pipe and hose assemblies, with or without meter, and with an interchangeable gasoline engine, electric motor, or hand-operated pump on a steel base.

Lube-A-Planes are manufactured by the Harman Equipment Co., 937 Santa Fe avenue, Los Angeles 21, Calif., in two-, four- or six-barrel units, which pump lubricating oil directly from refinery barrels. A barrel-tilting device permits one attendant to load heavy drums onto the trailer and dispense the oil.

Automatic Controller Electric Power Truck

The Newmatic controller, which operates as the electrical counterpart of the automobile automatic gearshift, has been adopted as standard equipment for all 1947 Automatic electric industrial trucks, by its designers,



The Newmatic Controller

the Automatic Transportation Company, 149 West Eighty-seventh street, Chicago 20. It provides automatically timed sequence of four speeds in forward and reverse and is said to eliminate jerky movement in starting, reversing or accelerating, thus minimizing tire slippage and spillage of loads. It is claimed to reduce the peak electric current surges by two-thirds, thereby extending the service life of the entire electrical system almost indefinitely.

The Newmatic enables the operator of a truck to select any one of the four forward or reverse speeds at will. Regardless of the speed selected, however, the controller starts the truck in low speed and passes automatically through the sequence to the faster speed selected. The automatic sequence is timed at one second for passage through all four speeds, or one-third of a second between any two speeds, which tests proved to be sufficient delay to reduce peak electrical surges by two-thirds without affecting the speed of a truck's operation. To prevent accidental disturbance of this automatic sequence, timing is tamper-proof and non-adjustable except by replacing the air jet within the pneumatic cylinder.

In addition to the pneumatic master controller, which handles only small and constant currents to actuate the contactors, the system includes a newly designed reversing switch and contactor panel. All three elements are electrically interlocked but mechanically independent so that they may be positioned in any convenient arrangement on the truck. The reversing switch is mechanically interlocked with the seat or platform, depending upon the type of truck, so that "dead-man control" shuts off all power if the operator leaves his position.

NEWS

A. A. R. Electrical Section, Engineering Division

THE annual meeting of the Electrical Section, Engineering Division, Association of American Railroads, will be held at the Hotel Sherman, Chicago, on Tuesday, September 30.

I. C. in Gas-Turbine Project

THE Illinois Central is now participating in the gas-turbine research project sponsored by seven other roads and four coal companies under the joint auspices of Bituminous Coal Research, Inc. The road has been associated since 1944 with eight other lines in the development of a steam-turbine locomotive.

Transportation Corps Needs Engineers and Draftsmen

THE Transportation Corps Board located at the New York Port of Embarkation, Brooklyn, N. Y., needs mechanical engineers and draftsmen in its research and development program for military railway equipment. Projects include the design, actual development and test of new types and improved methods of military railway transportation. The Rail Branch of the Board needs qualified personnel who have specific experience. Experience should include design of steam locomotives, internal combustion engines and locomotives, or passenger and freight cars. These are Civil Service positions which range in salary from $4,100 to $8,100 per annum. More detailed information can be obtained by writing to Civilian Personnel Branch, Recruitment and Placement Section at New York Port of Embarkation, First Avenue and Fifty-eight street, Brooklyn, or, preferably, by personal interview.

A. S. M. E. to Hold 1947 Annual Meeting at Atlantic City

THE Chalfonte and Haddon Hall, Atlantice City, N. J., will be the headquarters hotels during the annual meeting of the American Society of Mechanical Engineers, December 1 to 5, inclusive. Only on two other occasions have the annual meetings of the Society been held outside New York where this year hotel congestion is expected to result from meetings of the United Nations.

"The Engineers' Responsibility in Increasing National Productivity" is the theme adopted for this year's series of A. S. M. E. meetings.

A. A. R. Continues Brake-Beam and Reefer Research

R. V. FLETCHER, president, Association of American Railroads, at a meeting of the directors of the association in Washington, D. C., on February 28, revealed that the board had approved appropriations for additional research work on brake beams and refrigerator cars. The brake-beam study will be a project undertaken jointly by the A. A. R. and brake-beam manufacturers in an effort to improve the design and performance of the beams. Seven new designs will be tested, with the laboratory work done at the American Steel Foundries Company plant at Granite City, Ill., and the field tests made by railroads on four types of cars—box, refrigerator, hopper and tank.

The reefer research project is a continuation of that on which the A. A. R. has been cooperating with the refrigerator car lines, the United Fruit & Vegetable Association, the Department of Agriculture and the Bureau of Standards. The A. A. R. voted to increase its 1947 appropriation for this project by $60,000—from $50,000 to $110,000. Much of the additional amount will be used for the de-

Orders and Inquiries for New Equipment Placed Since the Closing of the March Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Canadian National	18[1]	1,000-hp. Diesel-elec. switch	Electro-Motive
	10[1]	1,000-hp. Diesel-elec. switch	American Loco. Co.
Chesapeake & Ohio	5[2]	4-8-4	Lima Loco. Wks.
	5[2]	4-6-4	Baldwin Loco. Wks.
Chicago, Indianapolis & Louisville	1[3]	3,000-hp. Diesel-elec. pass.	Electro-Motive
	1[3]	1,500-hp. Diesel-elec. (B type unit)	Electro-Motive
	1[3]	1,500 hp. Diesel-elec. road switch	American Loco. Co.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Adirondack Bottled Gas Co.	3	50-ton tank	American Car & Fdry.
Chicago, Indianapolis & Louisville	100	70-ton hopper	General American
Consolidated Chemical Industries	10	100-ton tank	American Car & Fdry.
General American Transportation Corp.	10	70-ton tank	Co. shops
	40	50-ton tank	Co. shops
	60	40-ton tank	Co. shops
	4	70-ton covered hopper	Co. shops
	10	40-ton covered hopper	Co. shops
Detroit, Toledo & Ironton	200	50-ton box	American Car & Fdry.
Gulf Coast Lines (Missouri Pacific System)	50	50-ton auto	System shops
Home Gas Corp.	3	50-ton tank	American Car & Fdry.
Illinois Central	500[4]	50-ton hopper	American Car & Fdry.
	500[4]	50-ton hopper	General American
International-Great Northern (Missouri-Pacific System)	50	50-ton covered hopper	System shops
	50	50-ton auto	System shops
	50	40-ton stock	System shops
Missouri Pacific	600	50-ton auto	Co. shops
	50	70-ton covered hopper	Co. shops
	50	50-ton gondola	Co. shops
Monsanto Chemical Co.	14	70-ton tank	American Transp.
Norfolk & Western	100	70-ton covered hopper	Co. shops
Pacific Gas Co.	50	40-ton tank	American Car & Fdry.
Seaboard Air Line	300	70-ton covered hopper	Pullman-Standard
Southern Pacific	1,500	50-ton gondolas	Pressed Steel Car
	500	50-ton auto	Pressed Steel Car
	500	50-ton gondolas	Ralston Steel Car
	100	70-ton gondolas	General American
	1,500	50-ton box	American Car & Fdry.
	1,500	50-ton box	Pullman-Standard
Spokane International	2	70-ton covered hopper	General American
Wabash[5]	500	50-ton box	American Car & Fdry.

FREIGHT-CAR INQUIRIES

Road	No. of cars	Type of car	Builder
Atchison, Topeka & Santa Fe	500	50-ton auto	
Chicago & North Western	1,400[6]	50-ton box	
Chicago, Indianapolis & Louisville	200	Gondolas	
	100	50-ton box	
	100	50-ton box	
Chicago, Rock Island & Pacific	1,000	50-ton box	
Lehigh & New England	100	70-ton covered hopper	
Southern	3,000	50-ton box	
	1,000	50-ton hopper	

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atlantic Coast Line	50	50-ton pass-exp. refrig.	American Car & Fdry.
Chesapeake & Ohio	10	Bagg.-mail	
	8	Postoffice	

[1] These orders, are in addition to those recently placed for 20 Diesel-electric engines, 18 of which will be built by the Canadian Locomotive Company at Kingston, Ont., and 2 by the General Electric Company at Erie, Pa.

[2] Deliveries scheduled for late this year. The 4-6-4's are to be equipped with poppet valves.

[3] The 3,000-hp. engine will consist of two F-3 class cabs geared for a speed of 100 m. p. h. and the B-type unit, also of the F-3 class, will be used to increase the capacity of one of the road's two-unit 3,000-hp. Diesel-electric freight locomotives to 4,500-hp. It will be geared for a 65-m. p. h. speed. The switching engine will be suitable for hauling light passenger and freight trains as well as performing switching and transfer service.

[4] The total cost of these cars will be over $3,500,000. On March 1 work was begun on 450 hopper cars in the road's own shops at Centralia, Ill. Immediately following the construction of the hopper cars, which will be completed in May, the Illinois Central's program calls for the building of 1,000 box cars and 500 automobile cars.

[5] The Wabash has ordered the rebuilding of 200 55-ton hopper cars and 233 40-ton box cars in its Decatur, Ill., shops during 1947.

[6] Four-hundred of these for the Chicago, St. Paul, Minneapolis & Omaha.

NOTE:—*Alton.*—The order for 15 coaches placed by the Alton with the American Car and Foundry Company in July, 1945, has been changed to call for 11 coaches and 4 parlor cars.

New Orleans & Lower Coast. The purchase of three 660-hp. Diesel locomotives at a cost of $212,000 has been authorized for the New Orleans & Lower Coast (owned by the Missouri Pacific) at a board of directors meeting of the M. P. The new Diesels will replace four steam locomotives which have been in service for more than 50 years, and will completely Dieselize the 60-mile road.

velopment of specialized instruments for the tests of insulation in reefers under all road conditions.

Would Alter Salary Provisions of Locomotive Inspection Act

CHAIRMAN WHITE of the Senate committee on interstate and foreign commerce has introduced, "by request," a bill (S. 562) to amend the salary provisions of the Locomotive Inspection Act. The amendments would give the Interstate Commerce Commission authority to allocate the positions of director of locomotive inspection, assistant directors, and district inspectors to their proper civil-service grades and to fix the compensation "subject to the Classification Act of 1923." The act now names the salaries to be paid.

Krieg Joins Staff of Machine Tool Association

ALVIN L. KRIEG, formerly assistant to the director of public relations for the American Steel & Wire Co., a subsidiary of United States Steel Corporation, has been appointed assistant to the general manager of the National Machine Tool Builders' Association.

Shop Improvements

Chicago, Indianapolis & Louisville.—The C. I. & L. will spend $200,000 for the conversion of part of its steam locomotive shop at Lafayette, Ind., to facilitate the repair of Diesel locomotives.

Chicago, Milwaukee, St. Paul & Pacific.—The Milwaukee has included the construction of a new passenger car-shop building in its program of modernization and improvement of shop facilities at Milwaukee, Wis. Forging and steel fabricating facilities will be provided, as well as new covered craneways.

Missouri Pacific.—The Missouri Pacific will construct a roadway machine repair shop at Sedalia, Mo., at an estimated cost of $95,000.

Accident Report Condemns Welding of Journal

REPORTING on an Apache Railway accident found to have been caused by the failure of a tender-truck journal that had been built up by fusion welding, the Interstate Commerce Commission has taken occasion to issue a strong condemnation of such practice.

The Apache is a 72-mile line in Arizona, and the report by Commissioner Patterson follows a Bureau of Locomotive Inspection investigation of a February 3 derailment which resulted in the death of a fireman and brakeman and the serious injury of an engineer. The derailment came when the No. 2 axle of the front tender truck broke and the back corner of the truck dropped to the track. The locomotive, tender and first car were derailed and turned over, coming to rest on the slope of an embankment. The locomotive cab was crushed and steam pipes in the cab were broken.

"The prohibitions of application of fusion welding on axles and the necessity, in the interest of safety, of removing from service any axles that are found to have had such welding applied, are so well known and understood that discussion of this pernicious practice, which has been universally long recognized as destructive to life and property, would here be redundant," the report said. "Freedom from accidents caused by application of fusion welding to members of assemblages that are ordinarily adversely affected thereby and which are concealed by related parts when assembled, such as wheel fits and journals, depends practically wholly upon the competency or integrity of those to whom the making of repairs is entrusted since no inspection methods short of disassembly will disclose the unsafe conditions."

Examination of parts involved in the accident disclosed that the left journal of the No. 2 axle of the front tender truck was broken off of the fillet. As the report described it, "approximately 75 per cent of the cross-sectional area was a progressive fracture which extended around the entire circumference of the journal at the junction of the journal and fillet and inwardly from the surface of the journal," the remainder of the break being new. The journal and brass remained in the box "and there was no evidence of cutting or overheating."

"The journal, including the fillet," the report continued, "had been built up by fusion welding and the deposited metal had been machined to a smooth surface. The diameter of the journal was $5\frac{15}{16}$ in. Stenciling on the axle indicated that it was first placed in use in 1919. No record of subsequent use or repairs was obtainable. The locomotive received last annual inspection and repairs . . . on September 3, 1946. . . . The last monthly inspection was made . . . on January 3, 1947. Daily inspection and repair reports on file for 60 days preceding the accident were examined and these did not show anything reported that would have a bearing on this accident."

In leading up to its condemnation of fusion welding on axles, the report recalled that a previous accident "of like nature" occurred October 13, 1939, also on the Apache. No deaths or serious injuries resulted from that derailment which was caused by the failure of tender-truck axle "to which fusion welding had been applied to build up the wheel fit."

* * *

The Chicago, Burlington & Quincy Vista-Dome passenger car built by the Budd Company undergoing compression tests in the Budd structural test laboratory—Compression test loads of 850,000 lb. at the center line of the coupler and 550,000 lb. at the center line of the buffer exceed A. A. R. specification loads by 50,000 lb.—In addition to the full car compression testing equipment, the laboratory includes testing machines for both static and fatigue testing of single structural parts and sub-assemblies—The main horizontal testing machine has a capacity of 2,000,000 lb.

Eastern Car Foreman's Group Reelects Officers

G. H. MASSY, superintendent motive power of the Central of New Jersey, has been reelected president of the Eastern Car Foreman's Association. P. J. Hogan, supervisor car inspection and maintenance of the New York, New Haven & Hartford; W. N. Messimer, assistant superintendent equipment of the New York Central; T. G. Case, general car foreman of the New York Central; and Wilson P. Dizard of the American Car and Foundry Company, were reelected, respectively, first vice-president, second vice-president, treasurer and secretary.

The Tough Guy, or the Chilled Car Wheel of today, is an educated wheel. He has passed many rigid tests. He has been subjected to many stiff examinations to fit himself for hard service.

We at AMCCW see to it that he himself is plenty hard. To Brinell hardness tests for maximum and minimum chill limits have been added other hardness tests which confirm up-to-the-minute improvements in mottle zone control.

Today's higher freight speeds mean still harder knocks for the Tough Guy and he is more than equal to their demands.

5021

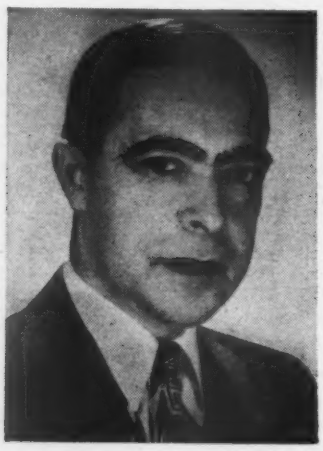
ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS
445 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.
American Car & Foundry Co. • Canadian Car & Foundry Co. • Griffin Wheel Co.
Marshall Car Wheel & Foundry Co. • Maryland Car Wheel Co. • New York Car Wheel Co.
Pullman-Standard Car Mfg. Co. • Southern Wheel (American Brake Shoe Co.)

Supply Trade Notes

LIMA LOCOMOTIVE WORKS.—*T. E. Satra* has been appointed manager of western sales of the Lima Locomotive Works, with headquarters in Seattle, Wash., to succeed *H. C. Hammack*, who has retired after 50 years' service. Mr. Satra was formerly assistant manager of the western sales office.

◆

WAUGH EQUIPMENT COMPANY. — The Longstreth Medal, annual award of the Franklin Institute for inventions of high order, will be presented to *Samuel Berman*, research engineer of the Waugh Laboratories division of the Waugh Equipment Company, on April 16. Mr. Berman will receive the medal "in consideration of the development of a metal locator for use in surgery which has greatly facilitated the location and removal of foreign metallic



Samuel Berman

bodies embedded in the tissues." This device, the Berman metal locator, was extensively used by Army and Navy hospitals during the war. The metal locator basically consists of an induction balance type locating probe operating in conjunction with a detecting unit. The approach of the probe to a metallic foreign body in the tissues is indicated by a dial and the hum of a loudspeaker. Especially effective in eye work, the detecting probe used is suitable for large and small foreign bodies. Magnetic and non-magnetic metallic bodies can be located and the depth at which they can be found is determined by their mass and their electrical and magnetic properties.

◆

UNITED STATES STEEL CORPORATION OF DELAWARE.—*Bennett S. Chapple, Jr.*, assistant to the sales vice-president of United States Steel Corporation of Delaware, has been appointed assistant sales vice-president, with headquarters at Pittsburgh, Pa.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION; INLAND STEEL COMPANY.—The Carnegie-Illinois Steel Corporation, a subsidiary of the United States Steel Corporation, has licensed the Inland Steel Company to manufacture Cor-Ten, the high-strength, corrosion-resistant, low-alloy steel developed by Carnegie-Illinois. Inland Steel, in turn, has licensed Carnegie-Illinois to manufacture Hi-Steel, a high-strength, corrosion-resistant, low-alloy steel developed by Inland Steel. Before 1944 Cor-Ten was produced solely by United States Steel subsidiaries. Since then, six companies, including Inland Steel, have been licensed to manufacture the special steel.

◆

UNITED STATES RUBBER COMPANY.—*Edwin D. Meade* has been appointed manager of the railway sales at the Chicago branch of the United States Rubber Company. Mr. Meade joined the company in 1935 and since 1941 has been located in the Washington, D. C., office. *L. Phil Haser*, who has handled the company's railroad sales in the Chicago district since 1903, will serve in a consulting capacity to Mr. Meade.

◆

TINNERMAN PRODUCTS, INC.—Tinnerman Products, Inc., Cleveland, Ohio, has licensed *Shakeproof, Inc.*, Division of Illinois Tool Works, Chicago, to manufacture and market Speed nuts and clips on which Tinnerman holds the patents. Classifications covered include the U and J types and latching type fasteners.

◆

COLORADO FUEL & IRON CORP.—*William S. Boyce*, whose appointment as manager of railroad sales of the Colorado Fuel & Iron Corp., with headquarters at Denver, Colo., appeared in the January issue, was born at Del Rio, Tex. He received his technical training at Texas A. & M. College. He served with the National of Mexico in maintenance and construction work in the maintenance department of the Chicago Great Western; and as a roadmaster of the Atchison, Topeka & Santa Fe. Subsequently, he was associated with the Rail Joint Company and the Railroad Supply Company. When the latter company was dissolved, Mr. Boyce organized his own business—the Boyce Tie Plate Company, Chicago. His close association with the Colorado Fuel & Iron Corp. later resulted in the dissolution of his own business, and the beginning of his sales activities for Colorado.

◆

CLEVELAND CHAIN & MANUFACTURING COMPANY.—*Woodhouse Chain Works.*—The Cleveland Chain & Manufacturing Co., Cleveland, Ohio, has announced the purchase of the Woodhouse Chain Works of Trenton, N. J., which will be operated under that name as a division of the company.

◆

ELECTRIC STORAGE BATTERY COMPANY.—*W. B. Bowie*, manager of the Pittsburgh, Pa., branch since 1938, has been appointed manager of railway and engineering sales for the Electric Storage Battery Company, at Philadelphia, Pa. *Kenneth W. Green*, assistant purchasing agent since August, 1946, has been appointed purchasing agent, to succeed the late *William B. Gold*. *C. J. Moore*, assistant manager of the Pittsburgh branch, succeeds Mr. Bowie as manager.

◆

REPUBLIC DRILL & TOOL CO.—*B. T. Cowherd* has been elected vice-president in charge of the Republic Drill & Tool Co.'s hardware sales in the eastern states, with headquarters in New York. Mr. Cowherd was formerly associated with the B. F. Goodrich Company for 22 years and just before joining Republic Drill & Tool was deputy zone administrator of the War Assets Administration in Chicago.

◆

FAIRBANKS, MORSE & CO.—*John A. Cuneo*, a member of the organizing staff of Fairbanks-Morse de Mexico in Mexico City for the past two years, has been appointed manager of the Los Angeles, Calif., branch of Fairbanks, Morse & Co., to succeed *Harry W. Brown*, retired. *J. F. Marquitz* has been appointed assistant manager, railroad division, with headquarters at Chicago. Mr. Marquitz has served in various capacities for the firm during the past 40 years, including that of assistant manager of the stoker division; dealer district manager at Dallas, Tex.; and manager of the company's branch office at Seattle, Wash. He held the latter position just prior to his recent appointment.

John A. Cuneo joined Fairbanks, Morse in 1929 as field engineer, export division.

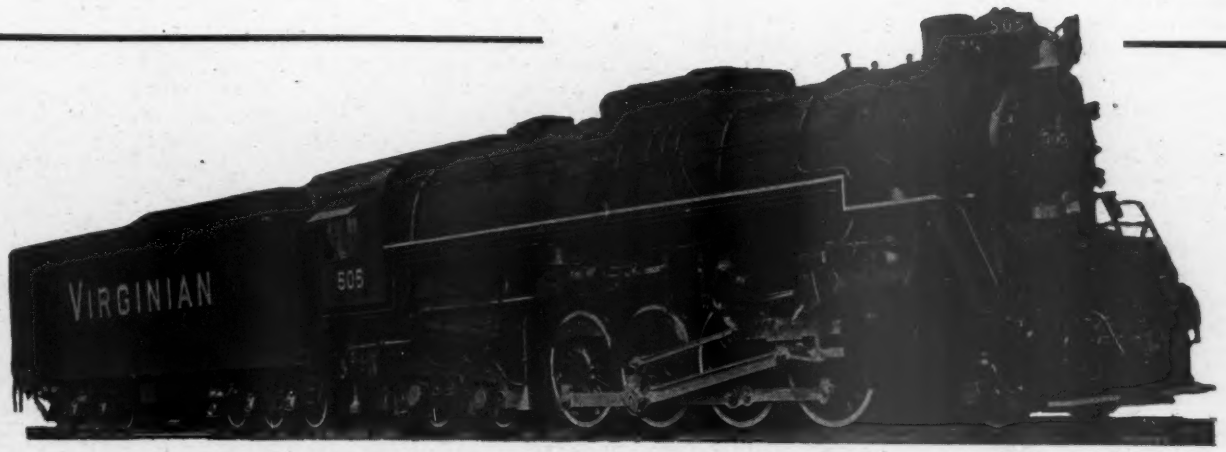
John A. Cuneo

He traveled in the West Indies and Latin America, and then became manager of the company's branch at Havana, Cuba. Mr. Cuneo was subsequently transferred to the export division at New York; to the scale division at Chicago, and to the position of manager of the scale department at St. Louis, Mo. More recently, Mr. Cuneo had been assistant manager of the export division at New York, and for the past two years had been a member of the organizing staff of Fairbanks-Morse de Mexico, at Mexico City, Mex.

◆

BENDIX AVIATION CORPORATION.—*L. F. Mathison*, formerly sales engineer at Baltimore, Md., for the radio division of the Bendix Aviation Corporation, has been ap-

It takes more than *SPEED–*



Coupled with today's need for speed is the problem of moving a large volume of traffic. The Virginian has realized this and is meeting these demands with a fleet of modern Lima-built 2-8-4's capable of moving freight at speeds closely approximating passenger schedules.

LIMA LOCOMOTIVE WORKS INCORPORATED, LIMA, OHIO

pointed manager of the division's Newark, N. J., sales office. This office will handle the sale of railroad radio communication equipment as well as yard loudspeaker systems.

◆

JOHN H. MCCARTNEY has resigned from the brake equipment and supply division of the H. K. Porter Company. Mr. McCartney, who has established offices at 120 Cliveden avenue, Glenside, Pa., will act as a sales and service representative for a number of manufacturers selling to railroads.

◆

AMERICAN CAR AND FOUNDRY COMPANY.—*T. C. Ballou* has been appointed manager of welded products sales, in charge of sales of weldments and welded products other than tanks, pressure vessels and cars of welded construction. Mr. Ballou's initials were incorrectly given in the text and under the portrait on page 153 of the March issue.

◆

ALLIS-CHALMERS MANUFACTURING COMPANY.—*Walter Giger,* in charge of railway sales and engineering in the electrical department of the Allis-Chalmers Manufacturing Company from 1931 through 1937, has rejoined the company and has been placed in charge of promoting the firm's interests in the transportation industry. Mr. Giger returns to Alli-Chalmers after serving as chief engineer in the railway locomotive division of Brown-Boveri & Co., Baden, Switzerland.

◆

DEVILBISS COMPANY.—The DeVilbiss Company, Toledo, Ohio, is conducting four one-week courses during the first half of its 1947 School of Spray Painting for industrial finishers. The first started January 13; the second March 10. Successive courses begin May 12 and June 23, each covering the same classroom instruction and shop work. Courses are given without charge to users of DeVilbiss Spray Equipment. All interested should write for reservations well in advance.

◆

GRAYBAR ELECTRIC COMPANY. — The Graybar Electric Company has announced the following changes in management: *Herbert Metz* has been appointed a member of the executive committee and eastern district manager at New York, in which capacities he succeeds *W. J. Drury* who has retired. *A. C. Lamperti* has been elected a director of the company and will continue as secretary and comptroller. *H. L. Harper,* Pacific district manager at Los Angeles, Calif., has been designated a voting trustee, also succeeding Mr. Drury.

◆

THOMAS A. EDISON, INC.—*William W. Gould,* field engineer of the storage battery division of Thomas A. Edison, Inc., with headquarters at the Philadelphia, Pa., district office, has been appointed district manager at Cleveland, Ohio. Mr. Gould began his career in 1923 as a draftsman on the Canadian Pacific. In 1924 he joined the Illinois Central as a draftsman, and was later promoted to the position of chief inspector. In 1930, he entered the service of the Delaware, Lackawanna & Western as construction foreman. In 1931 he was appointed electric supervisor of the Reading and in February 1943 he became field engineer storage battery division, Thomas A. Edison, Inc.

◆

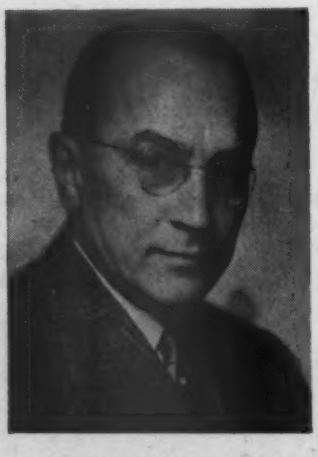
WAUKESHA MOTOR COMPANY. — The Waukesha Motor Company, Waukesha, Wis., has announced that its refrigeration division, producers of engine-driven air-conditioning and generator equipment for railway passenger cars, will now be known as the railway division.

◆

CANADIAN CAR & FOUNDRY CO.—*E. J. Cosford* has been appointed general sales manager of the Canadian Car & Foundry Co., with headquarters in Montreal, Que.

◆

SYMINGTON-GOULD CORPORATION. — *J. A. Sauer,* president of the Symington-Gould Corporation, has been awarded the Frederick A. Lorenz Memorial Medal for 1946 for the most outstanding contribution to the general welfare of the steel castings industry during the preceding year. The medal was presented to Mr. Sauer at the annual meeting of the Steel Founders' Society of America, held this year in Chicago. Mr. Sauer was born in Baltimore, Md., on May 11, 1888. After graduation from high school, he worked as a messenger and machinist apprentice in the Mt. Clare shops of the Baltimore & Ohio, in Baltimore, Md., from June, 1905, to September, 1907, when he joined the T. H. Symington Company at Baltimore as an office boy and assistant file clerk. In 1912 Mr. Sauer was transferred to New York where he studied evenings at the New York University School of Commerce and was graduated with the class of 1917. In July 1917, he transferred to Rochester, N. Y., as secretary of the Symington-Anderson Company, one of five war plants in Rochester and Chicago which were organized by T. H.



J. A. Sauer

Symington. Late in 1919, Mr. Sauer returned to New York as assistant to the vice-president of the T. H. Symington Company. He was appointed assistant to the president in 1922, and in 1924 was elected vice-president of the Symington Company, successor to the T. H. Symington Company. He was also vice-president of the Gould Coupler Company, which had been absorbed by Symington in 1925. When the two companies were merged in 1936, Mr. Sauer was appointed executive vice-president. He was elected president in May, 1944.

UNITED STATES STEEL COMPANY.—*Wallace W. Clevenger* has been appointed assistant district manager of the Cleveland, Ohio, warehouse of the United States Steel Company, a subsidiary of the United States Steel Corporation, to succeed *K. P. Rindfleisch,* who has been appointed district manager at Pittsburgh, Pa. Mr. Clevenger was formerly a sales representative in the Cleveland territory.

◆

AMERICAN LOCOMOTIVE COMPANY.—*John F. Corcoran* has been appointed district sales manager of the American Locomotive Company for the southeastern district, with headquarters in Atlanta, Ga., and *George L. Green* has been appointed district sales manager in charge of western regional sales, with headquarters in Chicago. Mr. Corcoran was formerly located at the company's Washington, D. C., office and Mr. Green was formerly vice-president of the H. K. Porter Company.

◆

BUCKEYE STEEL CASTINGS COMPANY.—*Charles F. Pigott* has been appointed sales representative of the Buckeye Steel Castings Company of Columbus, Ohio, with headquarters in the Railway Exchange building, 80 E. Jackson boulevard, Chicago. Mr. Pigott was formerly manager of the railroad sales department of the United Gypsum Company.

◆

WESTINGHOUSE ELECTRIC CORPORATION; JOSHUA HENDY IRON WORKS.—The Westinghouse Electric Corporation has taken over operation of the Sunnyvale, Calif., plant of the Joshua Hendy Iron Works under a lease arrangement. The plant will be operated under the direction of *Harry F. Boe,* vice-president in charge of the Westinghouse manufacturing and repair division.

C. B. Stainback, formerly manager of the industrial sales department of the Westinghouse Electric Corporation, has been appointed industrial syndicate manager, a newly created position. *John E. Payne,* formerly manager of industrial sales for the central district, succeeds Mr. Stainback as manager of the industrial sales department.

◆

AUTOMATIC TRANSPORTATION COMPANY.—*Herbert B. Cumming, Inc.,* northeastern New Jersey sales representative for the Automatic Transportation Company, Chicago, has announced the opening of a new sales display and service headquarters in Rochelle Park, N. J.

◆

SAFETY CAR HEATING & LIGHTING CO.—*C. W. T. Stuart,* vice-president of the Safety Car Heating & Lighting Co., has been elected a director.

◆

VANADIUM CORPORATION OF AMERICA.—*John B. Girdler* has been appointed assistant general manager of sales of the Vanadium Corporation of America, New York. Mr. Girdler was formerly district sales manager and will continue to handle sales in the eastern district.

◆

GOODYEAR TIRE & RUBBER CO.—*Dr. Jerome C. Hunsaker,* of Boston, Mass., has been elected a director of the Goodyear Tire & Rubber Co., succeeding *General R. E. Wood.*

From an Editorial in
RAILWAY MECHANICAL ENGINEER
—JANUARY, 1947

Steam Power Shows New Signs of Life

As 1946 passes into history and we review railroad operation for the year, we find that several interesting developments have been revealed during that year in the field of steam power.***

The operation of large 4-8-4 type locomotives with a total maintenance cost of only slightly more than 13 cents a mile over a four-year period shows definitely that the steam locomotive is not inherently expensive to maintain. Groups of steam locomotives given selected assignments and adequate servicing facilities, both en route and at terminals, average over 25,000 miles a month.***

Nor should it be forgotten that the steam locomotive of present day design can easily pack more than 5,000 drawbar horsepower in four axles and 5,000 horsepower carries a lot of weight maintaining even the fastest and most rigid of schedules.***

The steam locomotive design of today is not static. In addition to innumerable minor improvements that are being continuously made, there are two major developments that appear destined to have a marked effect on future locomotive design. Welded boilers*** The poppet valve gear may prove to be the answer to the problems of rising fuel prices and the rapid drop in horsepower that occurs in steam locomotives at high speeds. Thus it is apparent that the events of the past year, coupled with a look into the future, give a pretty strong indication that the steam locomotive will be with us for many years to come and that in the future it will give better and better service at lower and lower cost.

•

The Franklin System of Steam Distribution does prevent the rapid drop in horsepower that occurs with piston-valve locomotives. Actual test plant records show that IHP falls off less than 4% from 70 mph to 100 mph with poppet valves.

•

It is also true, however, that IHP is *also substantially increased.* The gain in drawbar pull, compared with similar piston-valve locomotives, has been as much as 24% at 60 mph and *44% at 80 mph.*

•

This greater horsepower is developed *with no increase in steam consumption.* It is produced solely by greater efficiency in converting steam into power. Therefore, at all power except maximum, there will be substantial savings in fuel and water — and, with lower steam demands on the boiler, *real reductions in boiler maintenance cost.*

Comprehensive test-plant data is available to show what the Franklin System of Steam Distribution can do on a modern, well-designed locomotive. With these data, and data available from other extensive tests, it is possible to calculate, with a high degree of accuracy, the increase in power and the saving in steam and fuel which can be realized with any specific locomotive design — existing or under development.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

The merger of American Spiral Spring & Mfg. Co., and Fort Pitt Spring Co. has brought together two of the oldest spring manufacturers to form one of the *largest* spring producers in the country. This combined equipment and experience offers exceptionally complete facilities for the manufacture of all types of springs, from heavy coil and elliptic springs for cars and locomotives, to the smallest helical wire and flat springs for all purposes. Our engineering facilities are at your disposal to help solve your intricate spring problems.

PORTER-BUILT means BETTER-BUILT

American-Fort Pitt Spring Division
H. K. PORTER COMPANY, Inc.
PITTSBURGH 22, PENNSYLVANIA
District Offices in Principal Cities

A. O. SMITH CORPORATION.—The A. O. Smith Corporation has announced the appointment of *George P. Hough* as executive administrator of its Chicago district, to succeed *Don T. Allen*, who recently resigned. Mr. Hough was formerly assistant administrator in direct charge of certain sales activities. He now directs all sales for the company's products in the Middlewestern states.

◆

DAMPNEY COMPANY OF AMERICA.—The Dampney Company of America, Boston, Mass., has announced the appointment of *LaVern Warren Marsh* to its sales staff as special railroad representative.

◆

CUMMINS ENGINE COMPANY.—*Leonard W. Beck*, formerly acting general sales manager and manager of the central region for the Cummins Engine Company, has been appointed general sales manager. He will relinquish the regional post. *V. E. McMullen*, who has been serving as vice-president and general manager, has been appointed executive vice-president. *R. E. Huthsteiner*, vice-president, assistant general manager and controller, has been appointed vice-president and general manager.

◆

TEXAS COMPANY.—*J. M. P. McCraven*, assistant manager of the Texas Company at New York, has been transferred to the position of assistant manager at 1205 McCormick Building, Chicago 4.

◆

GENERAL MOTORS CORPORATION.—*P. H. Brennan*, formerly commercial sales manager for the Frigidaire division of the General Motors Corporation, has been appointed sales manager of the direct factory sales department.

◆

ALAN WOOD STEEL COMPANY.—*Perry L. Francis* has been appointed general manager of sales for the Alan Wood Steel Company.

◆

MINNEAPOLIS-HONEYWELL REGULATOR CO.—*L. M. Morley* has been elected a vice-president of the Minneapolis-Honeywell Regulator Company, with headquarters at Philadelphia, Pa. *H. E. Williams* has been appointed eastern regional sales manager for the heating controls division of the Company with headquarters in New York.

◆

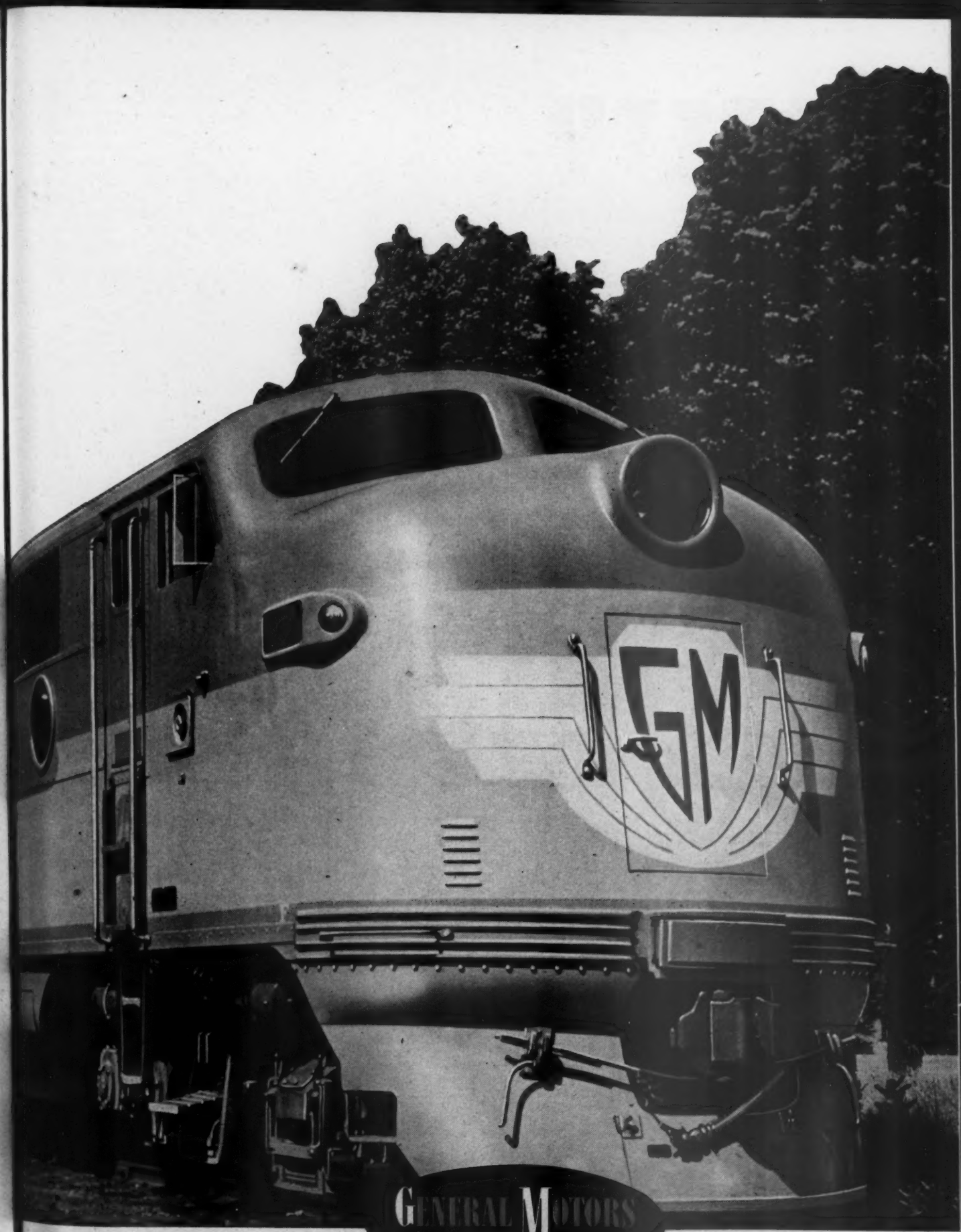
WESTINGHOUSE AIR BRAKE COMPANY.—*George L. Cotter*, assistant western manager of Westinghouse Air Brake Company, with headquarters at Chicago, has been promoted to western manager there, succeeding *A. K. Hohmyer*, deceased.

◆

BALDWIN LOCOMOTIVE WORKS.—*Ralph Schmidt*, formerly chief engineer of the Canadian Locomotive Company, has been appointed assistant to the chief engineer, development-steam products, of the Eddystone (Pa.) division of the Baldwin Locomotive Works.

◆

AMERICAN STEEL FOUNDRIES.—*Fritz B. Ernst*, whose retirement as vice-president in charge of sales of American Steel Foundries, with headquarters at Chicago, was reported in the March issue, is a graduate (1900) of Purdue University with a degree in civil engineering. He subsequently



ELECTRO-MOTIVE DIVISION

GENERAL MOTORS LA GRANGE, ILL.

BEATTY

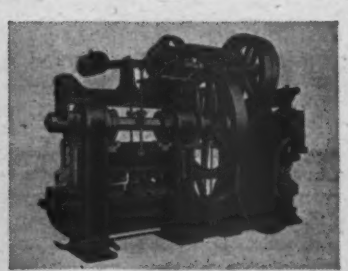
RAILROAD SHOP EQUIPMENT

WITH SPECIAL FORMING DIES AND PUNCHING TOOLS

No. 11-B HEAVY DUTY PUNCH offers exceptionally large die space, can be tooled to handle most complicated job in a single pass. Tooling of punch and spacing table always designed to the specific needs of the job to be done.

PRESS BRAKE AND FLANGER, combination 40-ton Flanger and 300-ton Press Brake handles any type of plate bending required in car and locomotive repairs — flanging, V-bending, forming, pressing and straightening.

CO-PUN-SHEAR provides a combination of Punching, Coping and Shearing tools assembled in working position, driven by a single motor and operated by independent clutches. Designed especially for car repair shops.



HYDRAULIC BULLDOZER designed to perform a wide range of forming, flanging and bending duties in railroad car shops.

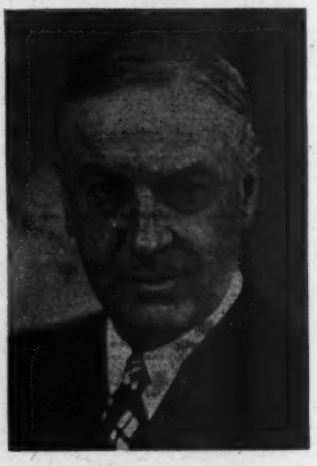
Write for complete information on the BEATTY line of mechanical and hydraulic punches, presses, shears and spacing tables.

BEATTY

MACHINE & MFG. COMPANY

HAMMOND, INDIANA

joined the editorial staff of the Railway Age. In 1902, he accepted a position at Purdue as instructor in car design, locomotive design, railway mechanical engineering and locomotive operation. Four years later he joined the Fitzhugh-Luther Company, at Hammond, Ind. In 1906, he became associated with the American Steel Foundries as sales engineer and salesman for miscellaneous steel castings, with headquarters at New York. Five years later he became



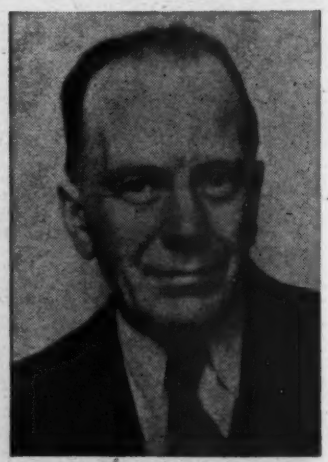
Fritz B. Ernst

assistant to the vice-president in charge of sales at Chicago and in 1929 was appointed vice-president in charge of sales.

◆

LUMINATOR, INC.—*Henry J. Van Dellen*, formerly general car inspector on the Alton, has been added to the staff of Luminator, Inc., Chicago.

Henry J. Van Dellen started his railroad career with the Chicago & North Western

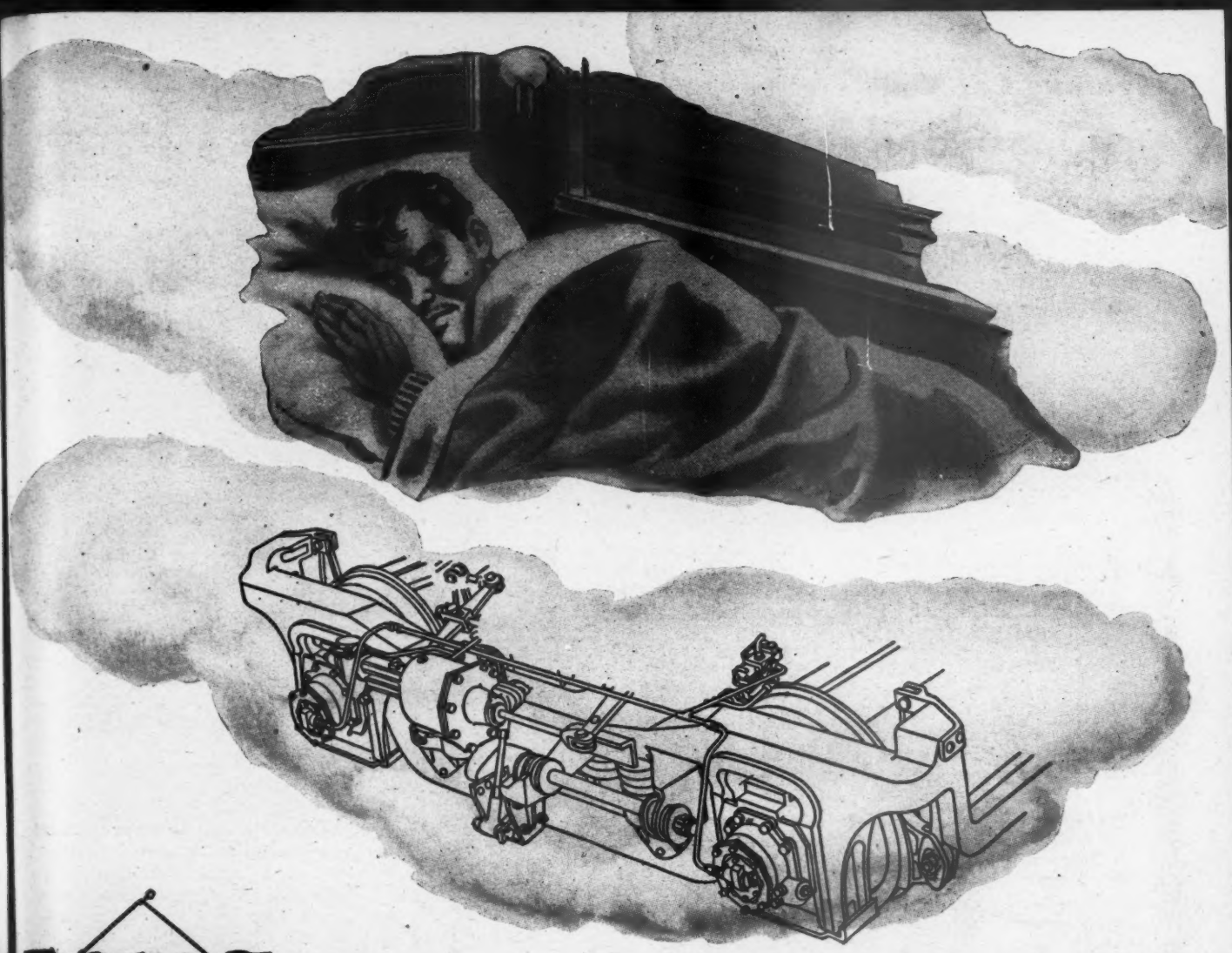


Henry J. Van Dellen

in 1922. He subsequently was associated with the Atchison, Topeka & Santa Fe, the General American Transportation Corporation, and the Union Tank Car Company. In 1928, he returned to the Chicago & North Western, where he served as shop engineer in the development of car lighting, air conditioning and modernization of railroad passenger cars.

◆

DURAMETALLIC CORPORATION OF NEW JERSEY.—*Herbert M. Lewis*, whose retirement as vice-president and general manager of the Durametallic Corporation of New



Portrait of a satisfied customer

. . . and how he got that way!

What new comforts are *your* new trains going to offer overnight travelers? The answer has a lot to do with future patronage.

When you're aiming for the tops in *smooth* service, it's important to give extra thought to the brakes. Westinghouse "HSC" electro-pneumatic brake equipment is made-to-measure for the job. It sets new standards in fast, positive, smooth deceleration that lets the engineer govern stops and slow-downs with precision slack control. It permits substantial improvements in schedules, too . . . important in any railroad's current plans. For your modern passenger-equipment, this modern braking combination is recommended:

"HSC" Electro-Pneumatic Brake . . . for brake flexibility to match modern train speeds, and unequaled smooth action. Speed Governor Control . . . for regulating brake forces to wheel speeds. "AP" Decelostat . . . for wheel slip detection to keep the wheels rolling.

Brakes are Basic to Railroad Progress

Westinghouse Air Brake Co.

WILMERDING, PA.

—Advertisement

Cleaning Car Tops on Diesel Electric Trains

The tops of the first few cars behind a diesel electric locomotive build up an especially stubborn dirt deposit, based on the exhaust fumes of the engine. Ordinary cleaners have no appreciable effect on these deposits . . . the nature of which requires solvent action, plus adequate dirt dispersion and suspension.

Magnus 77, a special type of emulsifiable-solvent cleaner, has been consistently successful in removing this dirt. The cleaner is brushed on the deposits, worked into them and allowed to soak in for a few minutes. When the surface is flushed off with hose water, the surface is left clean and bright, with all traces of dirt removed.

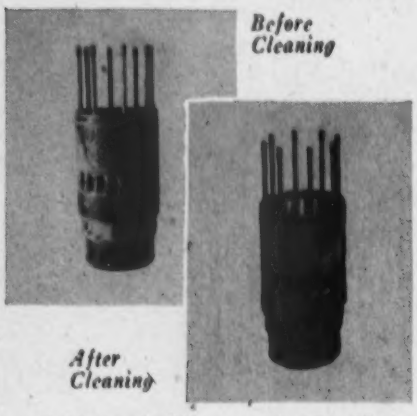
Cleaning Machine Cuts Time on Diesel Parts by 86%

The large Magnus Aja-Dip Cleaning Machine shown here has been in service in the diesel shop of a western railroad for nearly a half year. Formerly their heads, liners, pistons, connecting rods, blowers and other parts were cleaned in solvent in cold tanks. It formerly took 18 hours to clean eight liners, and 24 to 30 hours to clean heads.

With Magnus #755 as the cleaner and the faster cleaning made possible by the Magnus agitation principle of the Aja-Dip Machine, eight liners are

regularly cleaned in two hours or less, while heads can be put through in four hours. Parts cleaned with #755 in the machine are now ready for reinstallation in about one-fourth the time formerly required.

The quality of the cleaning job is reported to be much better than with the former cold tank cleaning method. The "before and after" pictures immediately below show a typical head as handled by the Magnus Machine. There is a wide range of capacities



available in the Magnus Aja-Dip Cleaning Machines, making it possible to meet any volume of cleaning production required, from the very small to the very largest scale.

Fast, Effective Cleaner for the Diesel Engine Room

Magnus 10-X is a mild alkaline cleaner containing an unusually effective wetting agent, providing a combination which is fast, safe and economical for cleaning the exterior of the diesel engine and its surroundings. It has no harmful action on finishes or painted surfaces, but does a speedy cleaning job, particularly with regard to oily or greasy dirt deposits.

A 2 ounce per gallon water solution of Magnus 10-X is wiped over all surfaces to be cleaned, followed by a dry-off with a clean wiper cloth. Usually no heavy scrubbing will be required, but in the case of heavy grease deposits, a little stronger solution may be used (up to 6 ounces per gallon).

Cleaning, Whitening and Hardening Concrete Surfaces

Keeping floors clean in the railroad shop will pay dividends in reduced accidents due to slippage, and in materially lengthened floor life. Greasy, oily dirt can be quickly and thoroughly removed from any concrete surface with Magnus Cement Cleaner.

This cleaner not only does a good cleaning job, but it whitens and hardens the concrete as well. Either a solution of the cleaner is used, or the cleaner itself is sprinkled on the surface and brushed in thoroughly with water. A water rinse leaves a clean, whitened surface. Regularly used, Magnus Cement Cleaner will keep floors safe, nonslippery and clean.

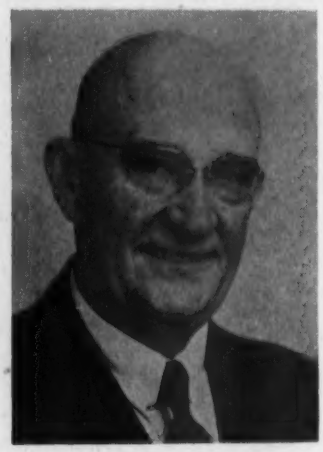
Magnus Railroad Cleaners & Machines

MAGNUS CHEMICAL COMPANY · 77 SOUTH AVE., GARWOOD, N. J.

Service Representatives in Principal Cities

IN CANADA — MAGNUS CHEMICALS, LTD., 4040 RUE MASSON, MONTREAL 36, QUE.

Jersey, was reported in the February issue, was born in 1878, at Montgomery, N. Y. He was educated at a business school in Newburgh, N. Y., and through the Inter-



Herbert M. Lewis

national Correspondence School at Scranton, Pa. He began his career as a machinist in a Brooklyn (N. Y.) bicycle shop. He later entered the employ of the New York, Ontario & Western as a machinist at Middletown, N. Y., and subsequently became machine shop inspector at Rome, N. Y. Mr. Lewis later became an inspector of locomotives for the Interstate Commerce Commission, assigned to the Pittsburgh (Pa.) district. In 1924 he left the I. C. C. and became associated with the Universal Packing Corporation of Pittsburgh, which eventually moved its office to Newark, N. J., and became the Durametallic Corporation of New Jersey.

◆

SKF Industries, Inc.—A factory building at Hornell, N. Y., has been purchased by SKF to house the cast iron department.

◆

Towmotor Corporation.—*Charles E. Smith*, vice-president of the Towmotor Corporation, Cleveland, Ohio, has been appointed to the newly-created position of executive vice-president. Mr. Smith was born at Buffalo, N. Y., and received his

Charles E. Smith

higher education at the University of Michigan. He joined Towmotor as sales manager in 1941 and became vice-president in 1943. Previously he served as branch manager for the American States Insurance Company, at Cleveland.

INTERCHEMICAL CORPORATION.—*Herbert B. Woodman*, former vice-president and secretary of the Interchemical Corporation, has been elected president to succeed *Ernest W. Pittman*, who has been elected to the newly created office of chairman of the executive committee.

J. R. Esposito has been elected a vice-president of the Corporation. He is succeeded as president of the finishes division by *J. G. Morris*, formerly executive vice-president of the division.

J. R. Esposito began his career as a salesman in the New York office of the Ault & Wiborg Corp., subsequently being promoted to manager of the varnish depart-

J. G. Morris

ment. In 1928, Ault & Wiborg became a subsidiary of Interchemical and later was consolidated with the Murphy Varnish Company and Scriver & Quinn to form Interchemical's finishes division. Mr. Esposito was president of the division and the former Ault & Wiborg Corp. from January, 1931, until his recent election.

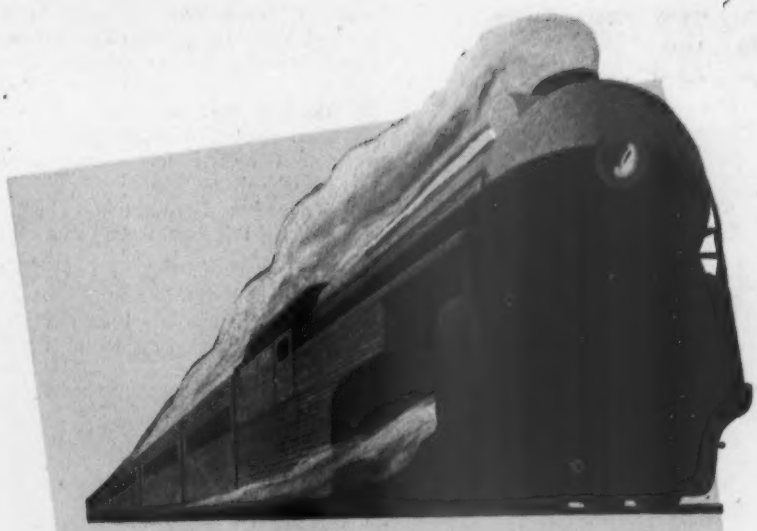
J. G. Morris joined Ault & Wiborg in March, 1931. Before coming east in Sep-

J. R. Esposito

tember, 1944, he was vice-president and general manager, with headquarters in the main plant, Cincinnati, Ohio.

◆

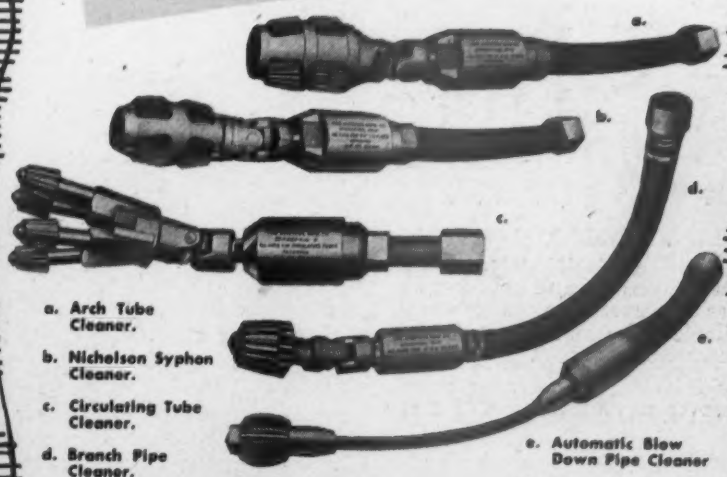
MAGNAFLUX CORPORATION.—A conference on the use of magnetic particle inspection in the welding field is to be held under the sponsorship of the Magnaflux Corporation at the Congress Hotel, Chi-



AIRETOOL TUBE CLEANERS
cut lost "on the road" time

Airetool tube cleaners, driven by Airetool's high powered motors, do a fast and thorough job of cleaning locomotive tubes — they put locomotives back on the road more quickly.

Airetool has a special line of tube cleaners designed for cleaning locomotive tubes. Shown below are a few of these most commonly used.



a. Arch Tube Cleaner.
b. Nicholson Syphon Cleaner.
c. Circulating Tube Cleaner.
d. Branch Pipe Cleaner.
e. Automatic Blow Down Pipe Cleaner

AIRETOOL TUBE EXPANDERS, made of special heat-treated alloy steels, are built for every tube rolling job in a locomotive or railroad power plant. Write our National Railways Sales Representative, Huron Manufacturing Co., 3240 East Woodbridge Street, Detroit 7, Michigan, for bulletins on locomotive and power plant cleaners and expanders.

There is an Airetool Tube Cleaner and Expander for every type of tubular construction.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

SEND FOR this Brickseal coated BRICK

make this Test yourself

Brickseal penetrates the pores and joints of firebrick and forms a highly glazed ceramic coating many times harder than the brick.

Tough and semi-plastic under heat, it prevents cracking and spalling regardless of temperature change—heat the sample and douse in cold water any number of times.

Brickseal resists abrasion. Force the sample brick, either hot or cold, against an emery wheel and see the difference on the coated and uncoated sides.

Brickseal is a superior mortar for fire walls. Try to pull the sample bricks apart after they are heated to 2200°.

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Brickseal

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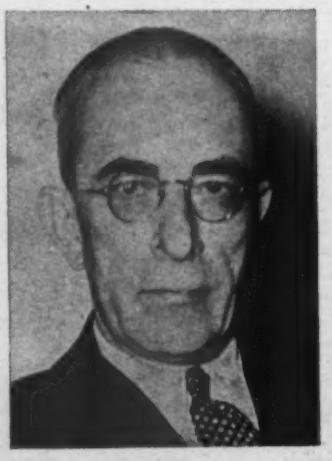
cago, on May 8 and 9. The meetings will be conducted on the basis of an open forum, with discussion leaders selected from the various fields in which this inspection method has been applied. Fluorescent penetrant inspection as applied to the inspection of welds in non-magnetic material will also be discussed. W. E. Thomas of the Magnaflux Corporation, Chicago, is in charge of this conference.

◆

PITTSBURGH STEEL PRODUCTS COMPANY.—*Thomas C. Phillips* has been elected vice-president in charge of sales of the Pitts-

Thomas C. Phillips

burgh Steel Products Company, a subsidiary of the Pittsburgh Steel Company. *Robert L. Glose* has been elected general man-



Robert L. Glose

ager of sales for the subsidiary, which will be the marketing division for the parent firm's construction products.

◆

AMERICAN BRAKE SHOE COMPANY.—*Frank A. Streiff* has been appointed assistant vice-president in the sales department of the Southern Wheel division of the American Brake Shoe Company, with headquarters in Portsmouth, Va. Mr. Streiff was formerly southeastern sales manager for the Southern Wheel division and sales representative for the brake shoe and castings division.

E. A. Williams has been appointed vice-president in charge of operations for the national bearing division of the American

INSTANT, DIRECT Temperature Readings Accurate to within a Fraction of a Scale Division with

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Trade Mark Reg. U. S. Pat. Off.

HAND PYROMETERS

Specify XACTEMP PYROMETERS wherever a quick, accurate temperature determination is needed. Used for surface temperatures of welds, welded rail ends, billets, slabs, heated rollers, forgings, ovens, hot plates, furnace walls—for general inspection in furnaces, lead and salt pots, galvanizing tanks, core ovens, type metal, etc. Long-life cast aluminum and brass construction. Medium resistance, fast-acting indicator, provided with Alnico V magnet—direct reading dial starts at 50° F. or 60° F. Simple, easy to operate—no adjustments necessary—always ready for use. Will take most types of thermocouples. A full line of thermocouples available from stock.

FOUR MODELS

Catalog No.	Range	Thermocouple
LT 800	60-800 F.	Iron-Constantan
LT 810	60-1200 F.	Iron-Constantan
LT 820	60-1600 F.	Iron-Constantan
LT 830	50-2500 F.	Chromel-Alumel

PRICE WITHOUT THERMOCOUPLE **$39.50**

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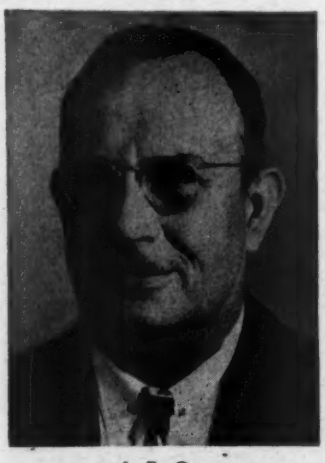
Brake Shoe Company and *I. E. Cox* has been appointed vice-president in charge of engineering for the same division.

Emmett A. Williams, works manager since April, 1942, has been with the national bearing division since 1913, working in an operating capacity. He attended Pennsylvania State college, where he studied business administration and factory management. His first job with the division was as chief clerk of the Meadville plant.

Emmett A. Williams

I. E. Cox, formerly chief engineer, started work in the division as research engineer in January, 1935. He was born in Kirkwood, Mo., and attended Washington University, St. Louis, Mo., and Union college, Schenectady, N. Y. Between 1916 and 1918 he was an instructor of electrical engineering at Washington University.



I. E. Cox

Obituary

FREDERICK T. VAUX, former vice-president and treasurer of the Adams & Westlake Co., died on February 21 in the Henrotin hospital, Chicago. Mr. Vaux was 88 years old. He was associated with the company for over 71 years and remained a director after his retirement from active business in 1923.

◆

JOSEPH FOARD GETTRUST, sales representative for the Ashton Valve Company, at Chicago, died at his home in that city on February 11, following a short illness. Mr. Gettrust was secretary of the Allied Railway Supply Association, and a past presi-

the new Interwoven MILLERPAX
JOURNAL BOX PACKING WASTE

3 advantages because

Fewer waste grabs — no impurities or small segments of waste to get between the bearing and the journal.

Fewer waste wipes — absence of free lint and short ends insures uninterrupted flow of oil to all parts of the bearing.

Less pulling of the packing — INTERWOVEN body of waste holds together in one firm mass, preventing packing wipes.

All grit, paper, wood, metal, and other foreign particles have been removed.

A special air wash eliminates all free lint and short fibre waste.

The threads are thoroughly INTERWOVEN into a practically endless mass, leaving no loose ends.

MILLERPAX — Registration applied for. Manufacturing process, patent pending.

3 made in all-wool all-cotton any desired combination of the two

Write us today for a free sample.
Use it and prove these advantages for yourself.

Miller Waste Mills, Inc.
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NASH-FINCH CO. Minneapolis 4
Exclusive Railroad Sales Representative

FOR LONGER CAR LIFE...

PREVENT RUST THE SURE WAY

BACK PRIME NEW STEEL CAR SHEETS WITH...

NO-RUST

● Interior moisture on car sheets caused by condensation makes them easy prey to ravaging rust. As cars are pulled out of service for repairs, operating revenues decline and maintenance costs mount.

The safe, modern way to protect new car sheets from rust is to prime them with NO-RUST . . . the *shop-proved* rust preventive. NO-RUST is easy to apply . . . gives air-tight protection.

LASTS INDEFINITELY, ECONOMICAL TO USE

An application of NO-RUST will last indefinitely. It sets to a plastic firmness that will not crack or chip. NO-RUST is applied in a thin coat which greatly reduces the dead weight so apparent in other compounds. Specify NO-RUST whenever rust and corrosion is probable. It cuts costs, increases revenues.

We specialize in railroad protective finishes; GRAPAK front end paint . . . oil stain and car sealer . . . VERNIX floor hardener . . . freight car primer and finish.

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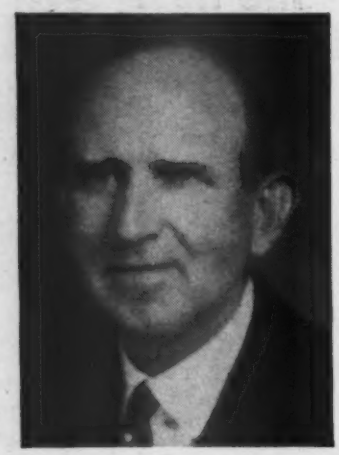
dent of the Railway Equipment Association, and the Air Brake Appliance Association. He began his career with the Cincinnati,



J. F. Gettrust

Indianapolis, St. Louis & Chicago (now Cleveland, Cincinnati, Chicago & St. Louis), and had been associated with the Ashton Valve Company for 35 years.

◆

COLONEL HARRY SCULLIN, formerly president and chairman of the board of directors of the Scullin Steel Company, St. Louis, Mo., died on February 15.

◆

HENRY B. NICKERSON, vice-president of the Ashton Valve Company, Cambridge, Mass., died on February 14.

◆

A. K. HOHMYER, western manager of the Westinghouse Air Brake Company at Chicago, died on February 11. Mr. Hohmyer began his association with the Westinghouse Company in 1901 as an office boy at the general offices in Wilmerding, Pa. In 1907 he was transferred to the Chicago district office where he served several years as chief clerk. He was subsequently promoted to the sales department, and served

A. K. Hohmyer

as a representative of the company in promoting railway sales. In 1922 he became associated with the New York Car Wheel Company, which was later merged into the Southern Wheel Company. In 1928 Mr. Hohmyer returned to the Westinghouse Air Brake Company as assistant western manager at Chicago, and on March 1, 1939, became district manager, Western district.

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Ratchet Lever Hoists

For all kinds of construction and maintenance work, wherever a lift or pull is needed, there is a "Safety - Pull" to meet your requirements. SAFE, DURABLE, DEPENDABLE. Capacities range from ¾ to 15 tons, yet they weigh only 14 to 150 pounds.

"QUIK-LIFT"
Electric Hoists

For dependable and economical service the "Quik - Lift" incorporates EFFICIENCY with SPEED, POWER and DURABILITY. Just plug it in and speed up production. Capacities from 500 to 4000 pounds with lifting speeds from 4 to 49 feet per minute.

MODEL Y-C
Spur Geared Chain Hoists

Coffing Spur Geared Chain Hoists embody the planetary gear system with the Weston automatic brake. There are seven capacities ranging from ½ to 5 tons. A sturdy, dependable hoist for heavy work and in the production line.

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Danville, Illinois U. S. A.

Personal Mention

General

R. W. SAVIDGE, head chemist of the Union Pacific at Omaha, Neb., has been appointed to the newly created position of chief chemist.

ELMER A. KUHN, master mechanic of the Pere Marquette at Saginaw, Mich., has been appointed superintendent of motive power, with headquarters at Grand Rapids, Mich.

J. L. CARVER, research engineer of the Illinois Central, at Chicago, has been appointed mechanical and research engineer, with the same headquarters.

W. S. BEAUREGARD has been appointed chief chemist at the West Albany, N. Y., laboratory of the New York Central System.

THOMAS W. BROWN has been appointed to the newly created position of chief water chemist of the Illinois Central, with headquarters at Chicago. The position of water chemist, formerly held by Mr. Brown, has been abolished.

Diesel

VIRGIL W. TREXLER has been appointed general Diesel supervisor of the Southern, with headquarters at Spencer, N. C.

LEE ROBINSON, superintendent of equipment of the Illinois Central, with headquarters at Chicago, has been appointed superintendent of Diesel power and shop machinery, with headquarters at Chicago.

Car Department

G. MCCREADY, general foreman, car shop, of the Canadian National at Montreal, Que., has been appointed superintendent, car shop, at London, Ont.

W. G. PALMER, superintendent of the car shop of the Canadian National, with headquarters at London, Ont., has been appointed assistant general superintendent car equipment of the Central region at Toronto, Ont.

C. F. WEAVER, assistant general superintendent car equipment Central region of the Canadian National at Toronto, Ont., has retired after many years of service. Mr. Weaver was born at London, England, and entered railroad service in 1919 as a carpenter at the Montreal, Que., car shop of the Canadian National. He subsequently served as assistant foreman and superintendent of car shop. In 1918 he was appointed superintendent of car equipment of the Montreal district; in 1937, superintendent of the car shop at London, and in March, 1943, assistant general superintendent car equipment at Toronto.

JOHN G. HAYES, superintendent of the passenger-car department of the St. Louis-San Francisco, with headquarters at Springfield, Mo., has retired after 47 years of railroad service. Mr. Hayes entered railroad service on February 1, 1899, with the Southern, at Memphis, Tenn., and later traveled out of Washington, D. C., as mechanical inspector for the superintendent of motive power and the superintendent of tests at Alexandria, Va. From March, 1903, to September, 1905, he served for short periods of time with several rail-

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Efficient plant and yard organization, fast action, big man-power saving with this mobile load-handler. Flexible performance, loads to 7½ tons, hook or magnet. Built for years of overwork. Write now for the money-saving facts.

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Load-Handling Specialists Since 1904

If you have a SPECIAL PROBLEM

in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—

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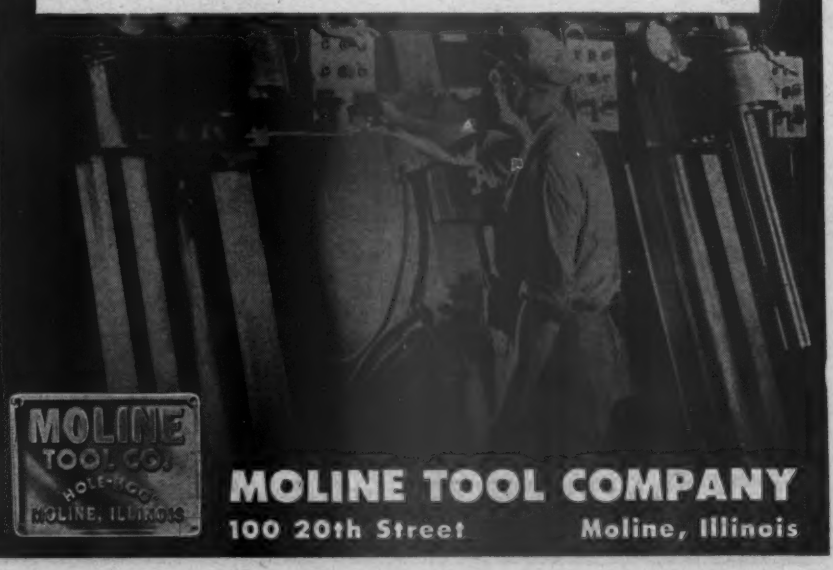
For YOUR special problem, go "HOLE-HOG," write us for any information you may need.



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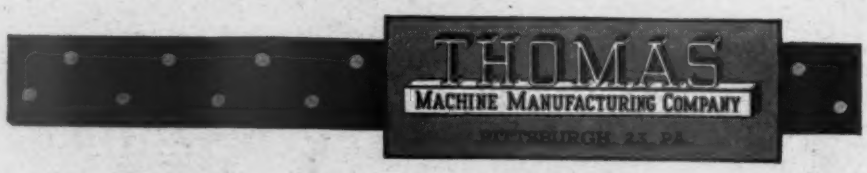
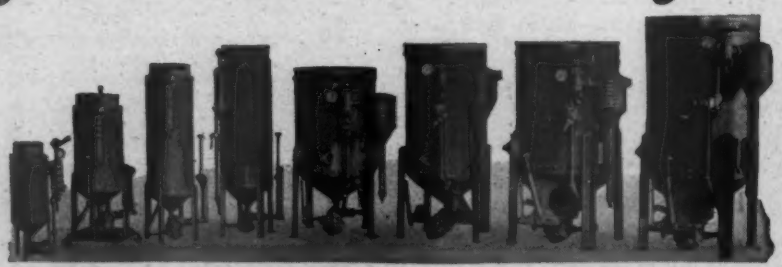
FOR accurate, economical production of rivet holes in plates or shapes, where quantity output is required, this famous Thomas Spacing Machine is the No. 1 choice of car builders and fabricators.

Write for Bulletin 306 or 306-A



RUEMELIN GENERATORS
for Railroad Sand-Blast Jobs!



RUEMELIN Blast Generators are used by leading railroads for cleaning castings, freight cars, locomotives, tenders before re-painting; removing rust and scale from steam piping. Portable or stationary models. Sturdily built for trouble-free service. Easy to operate.

Wet adapting nozzle attachment available at moderate price.

Some of our users include—

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Missouri Pacific Railroad
Seaboard Air Line
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RUEMELIN MFG. CO.

8082 NORTH PALMER STREET — MILWAUKEE 12, WISCONSIN, U. S. A.

MANUFACTURERS AND ENGINEERS
SAND BLAST and DUST COLLECTING EQUIPMENT

roads, and in the latter year he entered the service of the Southern Pacific. In 1925 Mr. Hayes joined the Frisco, and served as general car inspector and superintendent of the passenger car department.

Master Mechanics and Road Foremen

W. W. HENDERSON, master mechanic of the Hastings and Dakota division of the Chicago, Milwaukee, St. Paul & Pacific at Aberdeen, S. D., has been transferred to the Iowa division, with headquarters at Marion, Iowa.

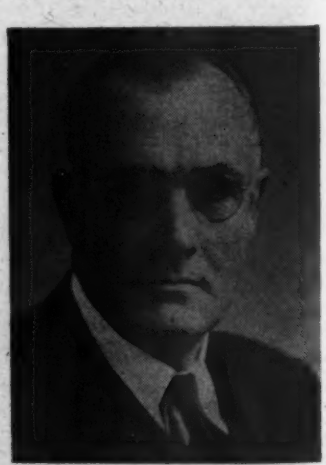
WALTER S. ANGEL has been appointed general road foreman of engines of the Southern, with headquarters at Spencer, N. C.

W. W. WALKER, master mechanic of the Western division of the Atchison, Topeka & Santa Fe, has been transferred to Winslow, Ariz.

H. T. ANKERSON, general foreman, locomotive department of the Southern Pacific at Tucson, Ariz., has been appointed assistant master mechanic, with headquarters at Eugene, Ore.

F. W. BUNCE, shop superintendent of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn., has been appointed master mechanic of the Chicago Terminal and Terre Haute division, with headquarters at Western Avenue, Chicago.

DALE ALEXANDER REA, whose appointment as road foreman of engines of the Bessemer & Lake Erie at Greenville, Pa., was announced in the January issue, was born on January 30, 1895, at Boyers, Pa. He attended Slippery Rock State Normal School at Slippery Rock, Pa. (1912-13), and entered the service of the B. & L. E. on July 29,1915, as a fireman. He became



D. A. Rea

locomotive engineer on June 18, 1923; traveling engineer, with headquarters at Butler, Pa., on June 26, 1936; assistant road foreman of engines at Butler on April 16, 1942, and assistant road foreman of engines at Greenville on October 1, 1945.

H. E. NIKSCH, master mechanic of the Chicago Terminal and Terre Haute division of the Chicago, Milwaukee, St. Paul & Pacific at Western Avenue, Chicago, has

TURNING ROLLS AND AUTOMATIC WELDING

Stationary turning rolls.

Self-propelled turning rolls.

The constant uniform speed of Ransome Turning Rolls makes them ideal for use with automatic welding heads when welding large circular tanks and cylinders.

The units are equipped with variable speed transmissions, giving a wide speed range and means for changing the center-to-center distance of the rollers for handling work of various diameters. Smoother, better welds and more economical production result. 17-6

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- WELDING POSITIONERS
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Ransome
MACHINERY COMPANY
Dunellen, New Jersey

Subsidiary of
WORTHINGTON PUMP AND MACHINERY CORPORATION

been transferred to the Hastings and Dakota division, with headquarters at Aberdeen, S. D.

H. E. CARTER, assistant master mechanic of the Southern Pacific at Eugene, Ore., has been appointed master mechanic, with headquarters at Tucson, Ariz.

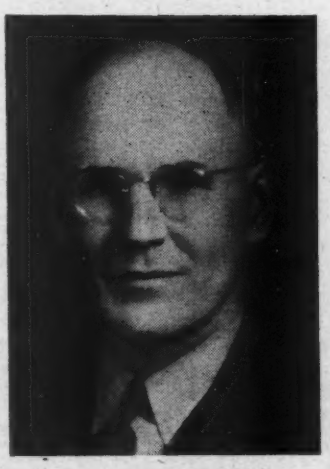
BENJAMAIN F. MADDEN, master mechanic of the Southern Pacific at Dunsmuir, Calif., has retired.

W. ERNEST BEAVER, general road foreman of engines of the Southern at Spencer, N. C., has retired.

T. T. BLICKLE, supervisor of Diesel engines of the Atchison, Topeka & Santa Fe, at Chicago, has been appointed master mechanic of the Western division, with headquarters at Dodge City, Kan.

RAY B. COBEAN has been appointed road foreman of engines of the Southern, with headquarters at Alexandria, Va.

JOHN LANDON FERTIG, whose appointment as master mechanic of the Panhandle & Santa Fe was announced in the February issue, was born on March 20, 1893, at La Junta, Colo. He attended high school at Montrose, Colo., and received his B.S. in mechanical engineering from the University of Colorado in 1917. He entered the employ of the Atchison, Topeka & Santa Fe on April 6, 1911, at La Junta where he completed his special apprenticeship on April 5, 1922. He was machinist and assistant enginehouse foreman at La Junta until April 3, 1933, when he was transferred to Albuquerque, N. M., where he served as tank shop foreman and general machine foreman. He became general locomotive foreman at La Junta on May 26, 1941 general shop foreman in September, 1941; general mechanical inspector at Topeka, Kan., on December 15, 1945, and master mechanic at Slaton on January 1, 1947.



J. L. Fertig

Shop and Enginehouse

F. L. KING, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Marion, Iowa, has been appointed shop superintendent, with headquarters at Minneapolis, with jurisdiction also to include the Twin City Terminals and Duluth division, succeeding Mr. Bunce.

THE PACKING THAT PACKS

For a more constant control of pressures, with reliable and positive operation stroke after stroke of the rods and valve stems, you need P-M Metallic Rod Packing. Efficient packing performance is assured by the use of the unique, tested and proven P-M engineered design. *Truly the packing that packs!*

FREE MAINTENANCE MANUAL—Get this valuable 32-page booklet showing proved methods for P-M Metallic Packing Installation and Maintenance. Keep it handy for ready reference if you service P-M packing installations. Sent free on request.

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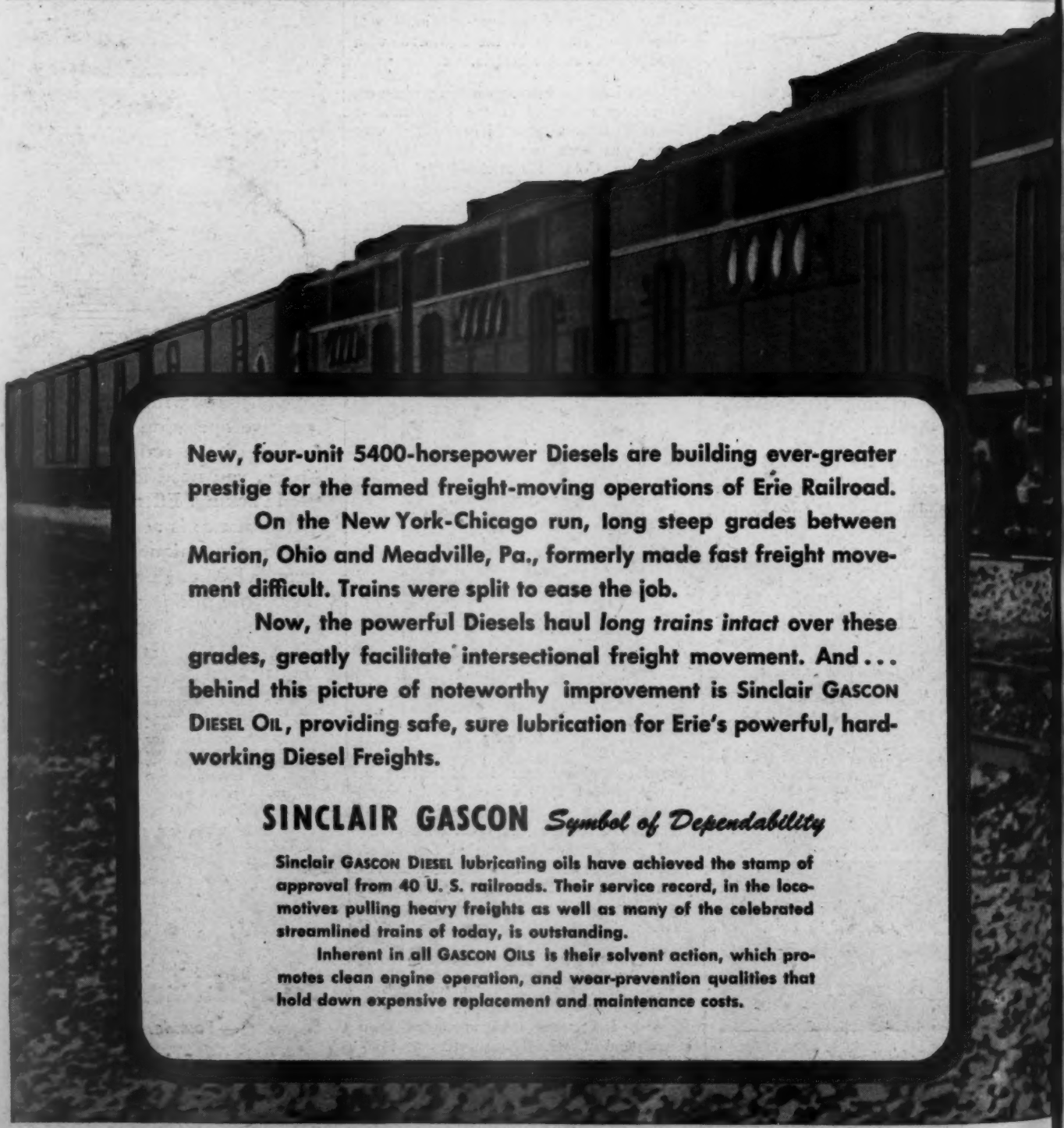
The Packing That Packs **P-M** *Metallic Rod Packing*

Paxton-Mitchell Company
Engineers—Founders—Craftsmen
OMAHA 5, NEBRASKA

Diesels Step Up Freight for *The ERIE!*



New, four-unit 5400-horsepower Diesels are building ever-greater prestige for the famed freight-moving operations of Erie Railroad.

On the New York-Chicago run, long steep grades between Marion, Ohio and Meadville, Pa., formerly made fast freight movement difficult. Trains were split to ease the job.

Now, the powerful Diesels haul *long trains intact* over these grades, greatly facilitate intersectional freight movement. And . . . behind this picture of noteworthy improvement is Sinclair GASCON DIESEL OIL, providing safe, sure lubrication for Erie's powerful, hard-working Diesel Freights.

SINCLAIR GASCON *Symbol of Dependability*

Sinclair GASCON DIESEL lubricating oils have achieved the stamp of approval from 40 U. S. railroads. Their service record, in the locomotives pulling heavy freights as well as many of the celebrated streamlined trains of today, is outstanding.

Inherent in all GASCON OILS is their solvent action, which promotes clean engine operation, and wear-prevention qualities that hold down expensive replacement and maintenance costs.